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INSTITUTE FOR DEFENSE ANALYSES

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PREFACE

The Institute for Defense Analyses (IDA) prepared this paper for the Joint Staff under a task entitled "Cost and Operational Effectiveness Analysis (COEA) for Prepositioned Equipment Maintenance Facilities: the Army Facility at Charleston, SC and Marine Corps Facility at Blount Island, FL." This paper directly answers the task's objective of determining whether collocating the two sites would save money without degrading operational effectiveness.

Bruce N. Angier, Stanley A. Horowitz, and Willard W. Scott of IDA were the technical reviewers for this paper.

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EXECUTIVE SUMMARY

INTRODUCTION

The maintenance sites located at Charleston, South Carolina, and Blount Island, Florida, perform all regularly scheduled intermediate-level maintenance on afloat prepositioning equipment. The purpose of collocating the sites would be to save on cost without lowering the effectiveness of support to the commanders in chief (CINCs) of the operating forces.

Costs could be saved if the one-time costs for building new facilities and moving equipment and people were covered by:

- reducing annual operating savings through economies of scale in the government and private workforces,
- sharing facilities, and
- improving efficiency in providing base housekeeping functions such as security, organic transportation, and utilities.

However, additional operating costs to cover an over-arching command (Joint Command or Executive Agent) would be needed to ensure resource sharing by the collocated Army and Marine Corps commands.

Most of our study compared the cost of the status quo with the cost of collocation at either site under a Joint Command. (Management by an Executive Agent was found to have similar features of cost and effectiveness.) It was beyond the scope of the study to consider the possibility of closing *both* sites and transferring their functions to depots or other maintenance sites. Effectiveness measured by support to the CINCs was held constant in that enough resources were procured for the collocation options to maintain the current 30-month maintenance cycle. IDA also considered whether collocation creates management problems or operational risks, factors we refer to as strategic consequences of collocation.

The summary costs in this chapter and Chapters I and IV are in discounted constant FY 1997 dollars, using rates mandated by the Office of Management and Budget

at the time the analysis was performed: 2.7%, 2.8%, and 2.9% for 5-, 10-, and 20-year comparisons, respectively.

RESULTS OF COST ANALYSIS

Initial considerations showed that it would not be possible to collocate "as is"—to assign the full maintenance load to one of the current sites without adding facilities or manpower. There is simply not enough excess capacity. Both sites are currently configured to maintain one shipload of cargo at a time. At the current maintenance time of 2 months per shipload, Blount Island will be barely able to service the 16 ships in the Marine Corps's FY 2000 force during the planned 30-month maintenance cycle. The situation at Charleston is similar.

Collocation "as is" is therefore out of the question unless the Services find ways to greatly shorten maintenance time or increase cycle time. However, Blount Island's 10 years of experience suggests that the Marine Corps ships could not be maintained at much under 2 months each. (Our study focuses on maintaining the prepositioning *cargo*, not the ships themselves.) The prepositioning maintenance cycle could be extended to greater than 30 months if the Services were relieved of the Coast Guard requirement to inspect ship hulls every 2-1/2 years. But that would not be an unmitigated blessing. Timely rotation means quicker renewal of cargo used in exercises and contingencies and earlier introduction of modifications and new equipment.

With additional resources, however, a collocated site could, indeed, save money. The figures in Table S-1 show that savings of approximately \$93 million would accrue over 20 years for collocation at Charleston and somewhat less for collocation at Blount Island. Table S-2 gives additional insight behind these figures. Collocation at Charleston would cost \$44 million initially and produce annual operating savings thereafter. (The operating savings are not simple multiples of the \$9 million saving for the one-year horizon because of discounting.) Figure S-1 shows the break-even point is 5 years. Collocating at Blount Island would incur higher one-time costs because, although there are lower costs for several items such as site improvements, there is a \$90 million charge for purchasing the land (estimate current at time of study). (Continuing to lease the land would cost even more for time periods above 8 years.)

**Table S-1. Costs of Separate Siting versus Collocation
(Millions of Discounted FY 1997 Dollars)**

Cost Horizon	Total Costs			Savings of Collocation	
	Separate Siting	Collocation at Charleston	Collocation at Blount Island	Collocation at Charleston	Collocation at Blount Island
1 year	\$227	\$263	\$296	-\$36	-\$69
5 years	\$747	\$749	\$782	-\$2	-\$35
10 years	\$1,312	\$1,278	\$1,312	\$34	\$0
20 years	\$2,215	\$2,122	\$2,157	\$93	\$58

**Table S-2. One-Time Costs and Total Operating Savings of Collocation
(Millions of Discounted FY 1997 Dollars)**

Cost Horizon	Collocation at Charleston		Collocation at Blount Island	
	One-time Costs	Total Operating Savings	One-Time Costs	Total Operating Savings
1 year	\$44	\$9	\$77	\$9
5 years	\$44	\$42	\$77	\$42
10 years	\$44	\$79	\$77	\$78
20 years	\$44	\$137	\$77	\$135

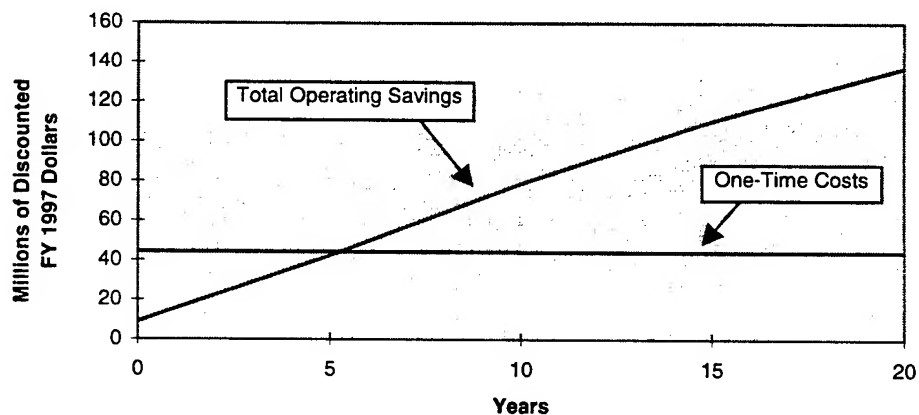


Figure S-1. Cost Break-Even Point for Collocation at Charleston

Although collocation at Charleston would save more money than collocation at Blount Island, the difference is not large, and collocation at Blount Island would have the advantage of expanding a site that has a history of 10 years of successful operations. As a result of these considerations, this study should be viewed as a comparison of collocation in general versus separate siting. Given a decision to collocate, a more detailed analysis of both cost and operational factors would be required to decide which site was best.

We considered two broad variations in estimating the resources required for collocation. The base case, whose results are reported above, involves a substantial expansion in facilities operated with a single-shift workforce. The variation is a smaller increase in facilities operated with a double-shift workforce. Relative to the base case, this variation yields a one-time saving of \$31 million in facilities but results in a \$6.7 million annual increase in the costs of the contractor workforce because of the inefficiencies and higher wages associated with double shifts and night work. The discounted values of these costs indicate that collocation savings over 5 years are approximately the same for the two options, but the single-shift case (base case) becomes substantially cheaper for longer time horizons.

The single-shift option also has the operational advantage of higher surge capability. (A substantial increase in capability could be needed if all the prepositioning ships of both Services had to respond immediately to a major contingency and required immediate maintenance thereafter to meet an additional threat.) Given its substantially larger facilities, maintenance output could be quickly doubled by hiring a second shift of contractors from the ready pool of retired Service maintenance people that exists along the Eastern seaboard. In the double-shift case, obtaining more facilities would take time, and adding a third manpower shift would increase output by less than 50%, after allowing for time to maintain the repair equipment and the inefficiencies of a midnight shift.

A variety of considerations, however, indicate that the above savings are too insubstantial to provide compelling support for collocation. First, Table S-3 shows the results of a sensitivity analysis of various factors included in the cost calculations. The break-even points between the one-time costs and annual operating savings vary from 3 years to 10 years.

Table S-3. Effects of Uncertain Factors on Savings from Collocation

	20-Year Costs (Millions of Discounted FY 1997 Dollars)			Percentage of Total ^a	Break-Even Points
	Separate Siting	Collocation at Charleston	Savings from Collocation		
Base Case	\$2,215	\$2,122	\$93	4.2%	5 years
Lower Savings	\$2,215	\$2,166	\$49	2.2%	10 years
Higher Savings	\$2,215	\$2,092	\$123	5.6%	3 years

^a Savings from collocation divided by costs for separate siting.

Second, as Table S-3 shows, the savings are only a small percentage of the combined current (discounted) costs of the two commands. The base case savings, for example, are only 4.2% of the current cost. Figure S-2 shows this graphically: the total accumulated budgets for separate siting and collocation at Charleston are nearly indistinguishable. The picture would not change noticeably even if the figures for the higher savings case were used for collocation. Moreover, only a relatively small increase in our estimated costs would be needed to completely eliminate the entire collocation saving.

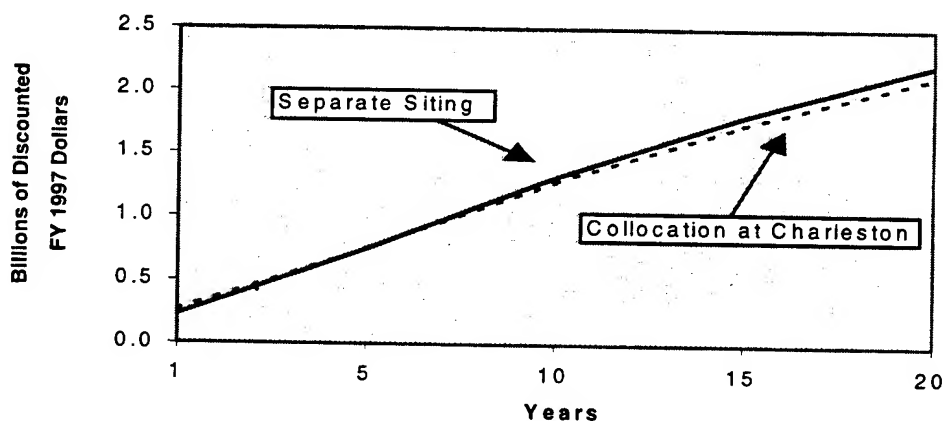


Figure S-2. Total Costs of Separate Siting versus Collocation

Finally, there is the possibility of a systematic bias in studies such as this that involve estimating the cost of large-scale actions without detailed engineering analysis. A recent General Accounting Office (GAO) report [1] bears on this issue. It deals with errors in estimating the cost of past base realignment actions carried out as part of the Defense Base Closure and Realignment Commission (referred to as BRAC). Specifically, it concerns actions taken by BRAC rounds I, II, and III on ten maintenance depots, bases with a similar mission to that of the prepositioning maintenance sites analyzed in our study.

The first three columns of Table S-4 are GAO's figures comparing the initial estimates using the aggregate Cost of Base Realignment Actions (COBRA) model with the budgets the Services eventually requested to perform the realignment action (see footnote b to the table for an explanation of slight adjustments to the GAO figures). Assuming that the Service requests are closer than the COBRA estimates to what was

actually spent, the figures in Table S-4 indicate that the actions required 31% more one-time cost and produced 23% less annual savings than indicated by the COBRA estimates. The GAO report gave the following main reasons for the errors: fewer eliminations of personnel and larger costs for civilian relocation and environmental cleanup.

**Table S-4. Effect on Collocation Costs of Uncertainty
in Realignment Costs for 10 Maintenance Depots
(Costs in Millions of FY 1997 Dollars)**

	BRAC Realignment Experience ^a			IDA Collocation Savings	
	COBRA Estimate	Later Service Estimate	Percentage Change	Base Case	Re-estimated
One-time costs	\$1,757	\$2,296	+31%	\$44	\$58
Annualized operating savings	\$537.3 ^b	\$415.7 ^b	-23%	\$6.9	\$5.3
Net annualized savings				\$4.7 ^c	\$2.4 ^c

^a The source of the BRAC figures are Reference [1]. The figures in [1], which were expressed in FY 1996 dollars, were increased by 2.6% to yield the figures in the table.

^b The 6-year savings reported in Reference [1] divided by 6. We deleted the savings from selling government land to local communities.

^c Annualized operating savings times 20 years (long-term horizon), less one-time costs, and then divided by 20.

These errors of estimation could apply to our study as well, since it is a top-down analysis without detailed engineering input, features common to COBRA studies. The last two columns in Table S-4 draw out the implications of the GAO results for the results of our analysis. The base case estimate for annualized operating savings is the 20-year discounted savings of \$137 million from Table S-2 divided by 20. The re-estimated figures are the product of the base case figures with the percentage errors from the BRAC actions. The net annualized savings calculated from the re-estimated values fall from \$4.7 million to \$2.3 million—from 4.4% to 2.1% of the costs for separate siting.

A final cost issue concerns the possibility of buying the Marine Corps site at Blount Island. The government currently leases the land from Gate Maritime Properties, Inc., for approximately \$11 million annually, and the Marine Corps wants to purchase it. (There are other ports on Blount Island, but these are part of the Jacksonville Port Authority.) It is obviously impossible to predict the results of possible future negotiations with Gate Maritime. However, if the land can be purchased at anywhere near \$90 million, the estimate current at the time of the analysis, it would clearly save money over the long run (over 8 years) to buy the site rather than continuing to lease it—*providing planners eventually decide in favor of separate siting or collocation at Blount Island*. This is *not* an argument for choosing either of these two options in the first place. That choice should depend on the total costs of all three options, including collocation at Charleston.

STRATEGIC CONSEQUENCES OF COLLOCATION

We found that strategic considerations uniformly favor separate siting. The following management problems might result with collocation:

- loss of responsiveness due to more layers of management;
- separation of afloat prepositioning from the rest of war reserve materiel management;
- separation of maintenance and organizational functions; and
- conflicts with Title X of the US code.

A Joint Command or Executive Agent, which would be necessary to ensure sharing of resources by the two commands, would mean additional layers of management and the possibility of less responsiveness. Collocating the two sites would remove each Services' prepositioning maintenance organization from its other war reserve functions such as depot maintenance and storage in CONUS and abroad. Collocation would also separate maintenance and organizational functions.

Some people have raised the possibility that collocation under either a Joint Command or an Executive Agent would conflict with Title X of the US Code. As amended by the Goldwater-Nichols Department of Defense Reorganization Act of 1986, Title X does give the Service Secretaries the responsibility for "construction, outfitting, and repair of military equipment" (Reference [2]). Both Services would obviously surrender some management control under a Joint Command. And one of the Services would surrender some control if the other one were made the Executive Agent. However, before they list the authorities assigned to the Service Secretaries, the sections containing the above quotation (one for each Service) all begin with the words, "Subject to the authority, direction, and control of the Secretary of Defense." A decision by the Secretary of Defense to collocate the two sites does not, therefore, appear to violate Title X.

Closing one of the maintenance facilities could also pose the following operational risks:

- vulnerability to weather, labor unrest, and terrorism;
- disruption of organizations during transition;
- loss of flexibility due to loss of a port; and
- loss of excess capacity for possible future expansion of the prepositioning forces.

These maintenance facilities would be most vulnerable to weather, labor unrest, and terrorism. Although history suggests that storms might close Charleston and Blount Island for only 2 days, the need for ships to steam out to sea and back could suspend maintenance operations for a week. The current contractor organization at Charleston reports no labor problems in 35 years of service to various military activities at the base, and Blount Island has had none in its 10 years of existence, but future uncertainty remains. Maintaining two sites would also offer some protection against the threat of terrorism, which could become a more serious problem in years to come.

We cannot be sure that prior planning would eliminate all possibilities of disruption during the transition to a collocated site. We included cost for 3 months of simultaneous operation at the losing site during transition. (Some maintenance people at the two sites felt that it could take 6 months to a year to re-establish normal operations.) Maintaining two ports would also offer a measure of flexibility that could be valuable in the event of major military actions in the future.

Finally, loss of a port would lower the Services' ability to handle a sizable expansion in future afloat prepositioning force levels. We know of no current plans for expansion beyond the fleets of fourteen Army and sixteen Marine Corps ships planned to be maintained at Charleston and Blount Island in 2000, respectively. However, the recently planned increases to reach these force levels suggest that afloat prepositioning has been regarded as an important part of US defense posture. It could become increasingly important given the recent shift in emphasis from major war to regional conflicts.

CONCLUSION AND RECOMMENDATION

Taking cost and strategic considerations together, we find no compelling reason to collocate the Charleston and Blount Island prepositioning sites. Our analysis suggests that a collocated site sized to maintain support to the CINCs would offer small and uncertain cost savings and could have strategic drawbacks. If the Army and Marine Corps afloat prepositioning maintenance organizations are allowed to continue operating at their current sites, the government should purchase the Blount Island site if the purchase price promises a long-term savings over yearly leasing.

I. INTRODUCTION AND SUMMARY OF COSTS

This report describes research by the Institute for Defense Analyses (IDA) on the cost and effectiveness of collocating the Army and Marine Corps prepositioning maintenance sites at Charleston, South Carolina, and Blount Island, Florida. These sites perform all regularly scheduled intermediate-level maintenance on afloat prepositioning, the unit and support equipment carried on Army and Marine Corps ships deployed to foreign waters in anticipation of military action. (Depot-level repair is performed elsewhere.)

A. CURRENT PREPOSITIONING PROGRAMS

The Army afloat prepositioning program is in the early stages of operation. It is managed by Combat Equipment Base-Asia, a tenant on the Naval Weapons Station at Charleston. The current fleet consists of twelve ships: five roll-on/roll-off (RO/RO) ships, one auxiliary crane ship (T-ACS), two containerships, three ammunition ships, and one heavy lift prepositioning ship. The Army plans to replace the RO/RO ships with eight new, large medium-speed RO/RO (LMSR) ships by the year 2000 or shortly thereafter. This study concerns the cargo on the eight new LMSR ships, the one T-ACS, and the two containerships that the Army now plans to maintain at Charleston at that time.

The Marine Corps program has been in existence since 1985. The cargo on its current thirteen Maritime Prepositioning Ships (MPSs) is maintained at Blount Island at facilities on land leased from Gate Maritime Properties, Inc. Funds have recently been authorized to obtain another three ships (Maritime Prepositioning Force Enhanced) by 2000 or shortly thereafter. These ships will provide port opening, hospital, and airfield equipment.

For purposes of analysis, we assumed that collocation, were it to take place, would occur in 2000. That would allow time for the Army and Marine Corps to receive their new ships and to plan the action.

Although we refer to maintaining the prepositioning fleets, we are concerned solely with maintaining the prepositioning *equipment*, not the ships themselves. Once the ships deposit their cargoes at Charleston and Blount Island, they proceed to various East

Coast ports for their own maintenance. (The ships are leased or owned and crewed by the Military Sealift Command, but we refer to them as Army and Marine Corps ships for convenience.) The need to maintain the ships has no effect on the wisdom of collocating Charleston and Blount Island. The choice of ship repair ports from among those on the East Coast would be made on the basis of prices at the time. Ship repair time would not be a factor, since it is much shorter than the time to repair the cargo.

Maintaining the ships does affect the prepositioning cycle time, however, in that the Coast Guard requires a hull inspection every 30 months. This constraint is not entirely counter-productive to the prepositioning program, however, in that the Services must maintain equipment after deployed exercises and contingencies and keep up with equipment modification and replacement. Current plans are to maintain the cargo on the eight Army LMSR ships, the Army T-ACS, and the sixteen Marine Corps ships on a 30-month cycle. (The thirteen Marine Corps ships are now maintained in 2 months.) The two Army containerships will operate on a 24-month cycle.

The in-port maintenance time for the Marine Corps ships (i.e., their cargo) in 2000 will likely be 2 months for the sixteen Marine Corps ships (the same as it is for the thirteen Marine Corps ships now). The Army is planning on 3 months for the LMSR ships, which are somewhat larger than the Marine Corps ships, but the time might approach 2 months as the Army gains more experience. We assume maintenance of the Army containerships' cargo will take 2 months.

B. POLICY ISSUES

Because of similarities between the Army and Marine Corps prepositioning programs, there has been contention for several years about the desirability of collocating the two maintenance sites. In 1993, then-Deputy Secretary of Defense Perry approved the recommendation of an earlier study by the Logistics Management Institute to establish the Charleston site, but he also asked the Army, Navy, and Chairman of the Joint Chiefs of Staff for a detailed Cost and Operational Effectiveness Analysis (COEA) of collocation. Congress concurred in the FY 1994 National Defense Authorization Act, which directed the Army and Marine Corps to establish separate sites but left open the possibility of collocation. The act asked DoD to defer relocation of the Marine Corps facility until the COEA was delivered to Congress. Further complicating the picture, the recent Commission on Roles and Missions of the Armed Forces recommended giving full responsibility for managing afloat prepositioning to the Marine Corps and ashore prepositioning to the Army.

To help resolve the issue, the Director for Logistics (J-4), Joint Chiefs of Staff, in early 1996 asked IDA to conduct a COEA on collocation. This report documents that analysis. It was beyond the scope of the study to consider the possibility of closing *both* sites and transferring their functions to depots or other maintenance sites.

C. ANALYSIS OBJECTIVES

The goal of the study was to determine if collocating the Charleston and Blount Island sites would save money without having a negative impact on support to the commanders in chief (CINCs) of the operating forces. Three areas of research were undertaken to analyze these issues:

1. Could a collocated site provide the same maintenance capability as the separate sites, thus providing the same operational effectiveness, or support to the CINCs? Would collocation "as is" be a reasonable option—do either of the sites have enough excess capacity to handle the combined workflow without additional resources? These questions are answered in the following subsection.
2. Assuming that additional resources were needed for a collocated site, would collocation yield a net saving? Would the annual savings pay for the up-front costs of new construction and relocation? What is the break-even point? What effect would cost uncertainties have on the study's findings? Chapters II, III, and IV address these questions.
3. What additional strategic risks might collocation pose, apart from the issues of maintenance capability and cost? We explore this question in Chapter V.

Cost savings would result if the one-time costs for new facilities and moving equipment and people were covered by the reduction in annual operating savings. Operating savings might be achieved through economies of scale in the government and private workforces, the sharing of facilities, and greater efficiencies in providing base housekeeping functions (Base Operations Support and Real Property Maintenance Activities) such as security, organic transportation, and utilities. There would be additional annual operating costs, however, to cover an over-arching command—Joint Command or Executive Agent—that we assume would be needed to ensure resource sharing by the Army and Marine Corps commands.

We measured effectiveness by the ability to maintain the current maintenance cycle of support to the CINCs and by consideration of strategic factors—the management and operational risks of collocation. For example, the over-arching command would mean additional layers of management and interruption of current Service trends toward

consolidating materiel management. Also, collocation might raise issues regarding Title X of the US Code, which assigns responsibility for maintaining military equipment to the Services. Collocation could also create operational risks in that closing a maintenance site would eliminate resources that could be useful in the event of bad weather, labor unrest, or terrorism.

D. ALTERNATIVES

We first considered collocation "as is" and found that maintaining both prepositioning fleets at either of the sites as they are currently configured could not provide the current level of support to the CINCs. The sites have little excess capacity now, and since there are no current plans for further substantial investment in facilities, they will have virtually *no* excess capacity to meet the current goal of a 30-month maintenance cycle for their expanded fleets in 2000. Both sites are now sized to maintain only one shipload of cargo at a time, so maintenance of the sixteen Marine Corps ships will take a total of 32 months to complete at the current 2-month maintenance time per ship. The Army ships will need 31 months: 3 months for each of the eight LMSRs and one T-ACS and 2 months for each of the two containerships. Thus, assigning all maintenance to one of the current sites without additional labor or capital would likely double the maintenance cycle.

Collocation "as is" is therefore out of the question unless the Services find ways to greatly shorten maintenance times or increase the cycle time. However, the fact that Blount Island has been in operation for 10 years suggests that its experience is a good predictor: the Marine Corps ships could not be maintained at much under 2 months each. The maintenance cycle could be extended to greater than 30 months if the Services received relief from the Coast Guard requirement to inspect ship hulls every 2-1/2 years. But that would not be an unmitigated blessing. Timely rotation means earlier renewal of cargo used in exercises and contingencies, and earlier introduction of modifications and new equipment.

Given enough additional resources, however, a collocated site at Charleston or Blount Island could obviously maintain the prepositioned cargo at the current maintenance cycle. For example, moving *all* capital and labor resources now at Blount Island to Charleston would certainly provide the same total maintenance capability, and thus support to the CINCs, that now exists at the separate sites. (There is enough infrastructure—port, rail, and road transportation going into both sites—to sustain a doubled workload.)

We next considered the nine possibilities created by the three management and three siting alternatives shown in Table I-1. Initial considerations, however, led us to consider only those marked "Yes" for detailed analysis. First, it seemed undesirable to consider managing a collocated site with two autonomous commands existing side by side (the second and third elements in the top row). Saving money, the primary purpose of collocation, would require some sharing of resources. And since each Service would be understandably partial to its own needs, an over-arching command—Joint Command or Executive Agent—would be required. (Consolidating the two commands into a single-Service organization was beyond the study's charter.)

Table I-1. Management-Siting Alternatives

	Separate Siting	Collocation at Charleston	Collocation at Blount Island
Autonomous Commands	Yes	—	—
Joint Command	—	Yes	Yes
Executive Agent ^a	—	—	—

^a Assumed to have approximately the same costs and effectiveness as Joint Command.

For a similar reason, we rejected the options of imposing a Joint Command or Executive Agent to manage the current separate sites (second and third elements in the first column). Two maintenance activities separated by 200 miles would likely find little opportunity to share resources. We assumed that the savings would not cover the one-time costs and the costs of the over-arching command.

Finally, we judged the difference between a Joint Command and an Executive Agent in terms of either cost or effectiveness was not enough to affect the decision between separate siting and collocation, the major focus of the study. We chose a Joint Command for purposes of costing.

The cost analysis was thus reduced to a comparison of the costs of keeping separate siting under the current management structure with the costs of collocation at either site under a Joint Command. We considered two resource variations under each of the collocation options:

- adding substantial maintenance facilities at the gaining site and operating them with a single-shift workforce, and
- keeping the facilities at the gaining site near the current level and operating them with a double-shift workforce.

E. COST GUIDELINES

We considered all nonrecurring and recurring costs for facilities, manpower, and supporting services such as transportation of prepositioning equipment to depots for repair above the intermediate level. Costs for the collocation options include the manpower expenses for the Joint Command. Costs are estimated for various time periods starting in year 2000. By 2000, the Army and Marine Corps would receive their new ships and have time to plan a possible future collocation.

All costs are expressed in constant FY 1997 dollars, and summary costs (in the next section of this chapter and the Executive Summary) are discounted to FY 1997 using rates mandated by the Office of Management and Budget. During the time of this analysis, the summer and fall of 1997, OMB mandated real rates of 2.7%, 2.8%, and 2.9% for 5-, 10-, and 20-year analyses, respectively.

Most of the data for this study were obtained from a comprehensive data call to the two prepositioning sites and follow-up discussions with logistics personnel at those sites, at the Charleston Naval Weapons Station, and at the Industrial Operations Command at Rock Island, Illinois. We also made use of information in reports listed in the references near the back of the paper.

F. SUMMARY OF COSTS

Table I-2 presents the table of undiscounted one-time and annual cost elements that were derived in the detailed analyses described in Chapters II and III. (The Charleston and Blount Island maintenance sites are abbreviated CHS and BI throughout.) These costs must be discounted to obtain the summary costs later in this section, in the Executive Summary, and in Chapter IV. One-time costs occur in 2000 and annual savings commence in 2001.

We use "total operating savings" to refer to the sum of annual operating savings over the time horizon. The term "total net savings" means total operating savings less the one-time costs. The total operating savings clearly depend on the time horizon. Table I-3 shows the one-time costs and total operating savings for 1, 5, 10, and 20 years. Table I-4 portrays the total net savings over 5, 10, and 20 years for separate siting and collocation. The percentage savings are the total net savings divided by the total costs for separate siting.

**Table I-2. Costs of Separate Siting and Collocation
(Millions of FY 1997 Dollars)**

	Separate Siting			Collocation	
	CHS	BI	Total	at CHS	at BI
One-Time Costs					
General site improvements	—	—	—	\$22.1	\$8.3
Refurbishment	—	\$6.0	\$6.0	—	\$6.0
Ship alterations	—	—	—	\$5.0	—
Construction of buildings	—	—	—	\$53.8	\$62.7
Movement of personnel, equipment and facilities	—	—	—	\$12.4	\$4.6
BI ownership					
Purchase cost	—	\$90.0	\$90.0	—	\$90.0
Lease termination	—	—	—	\$37.6	—
Personnel transition	—	—	—	\$13.2	\$8.3
Annual Costs					
Government workforce	\$4.1	\$5.2	\$9.4	\$7.9	\$7.9
Contractor workforce	\$29.2	\$47.4	\$76.6	\$70.9	\$69.9
Stevedoring	\$3.2	\$3.0	\$6.2	\$7.0	\$5.6
Spares and repair parts	\$15.1	\$13.4	\$28.5	\$28.5	\$28.5
Depot costs (receipt, repair, and preparation for shipment)	\$4.5	\$7.1	\$11.6	\$11.6	\$11.6
Second destination transportation	\$1.7	\$4.9	\$6.6	\$4.1	\$6.5
BOS	\$1.8	\$1.8	\$3.5	\$2.8	\$2.9
RPMA	\$1.0	\$1.0	\$2.0	\$1.6	\$1.8
Other facility support	\$3.7	\$6.3	\$9.9	\$9.9	\$9.9
Total costs, undiscounted					
One-time	—	\$96.0	\$96.0	\$144.1	\$179.9
Annual	\$64.3	\$90.0	\$154.3	\$144.4	\$144.5

Note: Totals may not sum due to rounding.

**Table I-3. One-Time Costs and Total Operating Savings of Collocation
(Millions of Discounted FY 1997 Dollars)**

Cost Horizon	Collocation at Charleston		Collocation at Blount Island	
	One-time Costs ^a	Total Operating Savings ^b	One-Time Costs ^a	Total Operating Savings ^b
1 year	\$44	\$9	\$77	\$9
5 years	\$44	\$42	\$77	\$42
10 years	\$44	\$79	\$77	\$78
20 years	\$44	\$137	\$77	\$135

^a Collocation less separate siting total one time costs from Table I-2, after discounting.

^b Separate siting total less collocation annual costs from Table I-2, after discounting and summing over years.

**Table I-4. Cost Savings from Collocation as a Function of Total Budgets
(Costs in Millions of Discounted FY 1997 Dollars)**

Cost Horizon	Total Costs			Total Net Savings		Annualized Savings		Percentage Savings	
	Separate Siting	Collocation		Collocation		Collocation		Collocation	
		at CHS	at BI	at CHS	at BI	at CHS	at BI	at CHS	at BI
5 years	\$747	\$749	\$782	-\$2	-\$35	-\$0.4	-\$7.0	-0.3%	-4.7%
10 years	\$1,312	\$1,278	\$1,312	\$34	\$0	\$3.4	\$0.0	2.6%	0.0%
20 years	\$2,215	\$2,122	\$2,157	\$93	\$58	\$4.6	\$2.9	4.2%	2.6%

As you can see from the tables, collocation at Charleston would save more money than collocation at Blount Island. However, the difference is not large, and collocation at Blount Island would have the advantage of expanding a site that has a history of 10 years of operations. As a result of these considerations, this study should be viewed as a comparison of collocation in general versus separate siting. Given a decision to collocate, a more detailed analysis would be required to decide which site was best considering both cost and operational factors.

The figures in Tables I-3 and I-4 indicate that the annual savings cover the one-time costs at about the fifth year. Figure I-1 portrays this break-even point graphically. Net savings after 20 years amount to approximately \$100 million in discounted costs. Note, however, that DoD would be spending almost \$50 million initially (Table I-3) to achieve an uncertain return of less than \$5 million annually (Table I-4), or approximately \$100 million over 20 years.

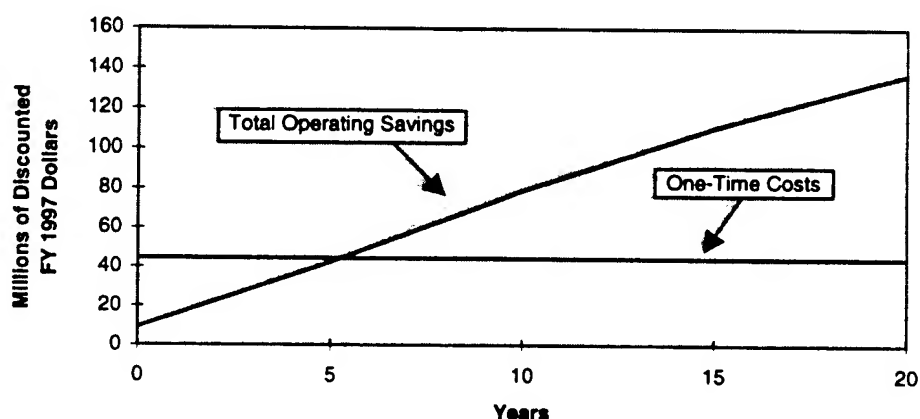


Figure I-1. Cost Break-Even Point for Collocation at Charleston

The next two chapters describe the analysis leading to the costs in Table I-2, including any variations in cost due to single- and double-shift operation.

II. ONE-TIME COSTS

A. GENERAL SITE IMPROVEMENTS

The costs of site improvements are based on information from several sources: the data call to each site, five follow-up visits to the two sites, earlier cost estimates developed by both Blount Island (BI) and Charleston (CHS), information provided by the Public Works Department at the Naval Weapons Station (NWS) Charleston, and the architectural and engineering firm that is supporting ongoing construction at the Army's maintenance site.

The steps of analysis were to estimate the site needs of the losing site (either Charleston or Blount Island), assess the ability of the gaining site to meet those needs, and estimate the cost of making up the difference. The results are discussed in the remainder of this section.

1. NSE Storage Area and Ramp

In addition to maintaining the ground combat and support equipment prepositioned on the ships, the Marine Corps maintains Air-Ground Support Equipment (AGSE) and Naval Support Equipment (NSE), which is the Navy's entire war reserve lighterage program. It conducts these functions at Blount Island and would need maintenance facilities to continue them in the event of collocation at Charleston.

For the NSE mission, Blount Island currently uses 27 acres of hardstand to store the lighters and a special ramp to move the lighters from the hardstand into the water before loading them onto the MPSs. Discussions with personnel from Blount Island and the NWS Charleston indicated that, although there is enough space near pier Charlie at Charleston for a lighter hardstand and ramp, extensive preparation of the site and construction of a ramp would be required. The NWS Public Works Department estimated that these improvements would cost \$6.0 million for the storage area and \$0.75 million for the ramp.

2. AGSE Clamshell Foundations

Blount Island currently uses four clamshells to store much of its AGSE. These clamshells are portable structures requiring electrical power and a foundation provided by reinforced concrete pads 8 inches thick. We assumed that the Marine Corps would take the clamshells with them if they relocated at Charleston. The costs of moving the clamshells are treated in the "Movement" section. Preparing the site would cost \$434 thousand to construct the 9,040 square yards of pad at Charleston, the space now used at Blount Island for the four clamshells (\$48 a square yard), plus \$90 thousand to run and hook up the electrical lines for a total of \$524 thousand.

3. Wharf Upgrade to Accommodate the Blount Island Crane

The port at Blount Island contains a large, 40-ton rail-mounted crane. The Marines installed this crane to help load and offload their MPSs, each of which carries approximately 490 containers of goods. The crane can unload 20 containers an hour, more than twice the rate of the ship's crane, and thus contributes to the Marines' ability to turn an MPS's cargo around in 2 months.

The Army plans to carry an average of 125 containers on each of its eight new LMSRs. It has not seen a need for a large container crane at Charleston. Moreover, it is planning on a month longer maintenance period than the Marine Corps. Use of the Blount Island crane could, however, also help the Army reduce its offload time since its work rate is much larger than the rates of the shipboard davits and Rough Terrain Cargo Handling vehicles the Army plans to use. We have therefore assumed that the 40-ton crane would be relocated to Charleston in the event of collocation there.

Installing the crane would require some modifications at wharf alpha. (The cost to physically move the crane to Charleston is considered in the "Movement" section.) Widening and reinforcing the wharf and replacing one of the existing rails would cost \$2.5 million according to an estimate by the Southern Division Naval Engineering Command.

4. Restoration of the Losing Site

We asked personnel at each site to estimate the cost of closing down and restoring the site. The NWS Public Works Department estimated \$809,000 to close the Army prepositioning site at Charleston for caretaker status. That estimate is based on the actual costs for closing the same facilities when the Polaris Maintenance Facility was shut down

in past years. NWS Charleston adjusted the historical cost by the number of buildings the Army is actually using, and updated the costs to FY 1997 dollars.

The Blount Island Command estimated \$4.845 million to close down its site. This is almost six times the estimate for closing down Charleston, but it requires much more effort. Whereas the Army would only have to prepare the buildings for caretaker status, the Marine Corps would be required by the terms of its lease to restore Blount Island to its original condition. This would include removing the facilities that the Marines had constructed.

5. Additional Hardstand

Both Blount Island and Charleston appear to have enough dockside hardstand to stage the additional shipload of equipment generated by collocation. Both sites, however, would need more hardstand at the maintenance facility itself. We assumed that each site has enough to meet its own needs at present. We used the area that the Army is planning for Charleston to approximate the needs at either site. Table II-1 multiplies the acres of material the Army has estimated will be in place by 2000 by the cost per acre for ongoing construction at Charleston.

**Table II-1. Calculation of the Cost of Additional Hardstand at Either Site
(Costs in Thousands of FY 1997 Dollars)**

	Concrete	Asphalt	Rock	Total
Acres	13.3	30.4	8.0	51.7
Cost per Acre	<u>× 233</u>	<u>× 121</u>	<u>× 87</u>	<u>× 144.55^a</u>
<i>Total Cost</i>	\$3,099	\$3,678	\$696	\$7,473

^a Average.

6. Summary

In summary, the site improvement figures in Table II-2 show that it costs almost three times as much in one-time costs to collocate at Charleston than at Blount Island. Of the \$14 million difference, about half is related to the costs of facilities to accommodate AGSE and NSE, missions that the Army maintenance facility does not have.

**Table II-2. Costs of General Site Improvement
(Millions of FY 1997 Dollars)**

	Separate	Collocation	
	Siting	at CHS	at BI
NSE storage area and ramp	—	6.750	—
AGSE clamshell foundations	—	.524	—
Wharf upgrade to accommodate BI crane	—	2.500	—
Restoration of the losing site	—	4.845	.809
Additional hardstand	—	7.473	7.473
<i>Total</i>	—	22.092	8.282

B. BLOUNT ISLAND REFURBISHMENT

We used the estimate by Analytical Systems Engineering Corporation [3] that the Marine facility at Blount Island requires a one-time facility refurbishment costing \$6 million. Similar costs would not be incurred at Charleston, which is using many facilities that were constructed years ago for the Polaris Maintenance Facility. These facilities are now receiving maintenance upgrades as part of the Army's extensive modifications to ready the site for prepositioning maintenance.

C. SHIP ALTERATIONS

Five of the Marine Corps's current force of thirteen MPSs have masts that are too tall to pass under one of the bridges over the Cooper River in the approach to the prepositioning maintenance port at Charleston. We accepted the Military Sealift Command's estimate of \$1 million to hinge the mast of each ship. According to the Marine Corps, none of the three ships planned under the new "MPF enhanced" program would have the mast-height problem.

D. CONSTRUCTION OF BUILDINGS

This section considers the costs of constructing new buildings required by collocation. Construction of facilities other than buildings, such as hardstands, was considered in Section A, General Site Improvements.

We calculated the cost of new buildings needed for collocation in four steps:

1. Estimate the space in square feet now used by each site.
2. Calculate the total space required at the gaining site.
3. Subtract the current space at the gaining site to determine the amount of new construction needed.

4. Estimate the cost of this new construction using standard Army facilities cost factors.

The costs for buildings are different for a single-shift and double-shift workforce. The need for new buildings varies substantially between single- and double-shift operation. Under single-shift operation, each worker would need his own maintenance area, so collocation requirements would be the *sum* of the separate utilizations. With a double shift, the day and night forces would use the same equipment, so the requirement would equal the *maximum* of those at the two sites.

The costs for a single-shift workforce are discussed first. Table II-3 presents the analysis for the base case. The available space is that now used by each site. The total required space is the combined available space for both sites, and the additional space needed for collocation is the difference between required and available space. For example, Charleston and Blount Island now use 328,100 and 227,700 square feet of maintenance space for ground equipment. They would thus require a total of 555,800 square feet of maintenance space, or an additional 227,700 square feet for Blount Island work if they were to collocate at Charleston. By exception, we assumed that needs for additional storage space would be 100 thousand square feet, an estimate made by the Packaging, Storage, and Containerization Center (PSCC) of the Army's Logistics Support Agency during its efforts to assist in the design of supply operations for Charleston. The PSCC estimate assumes optimal use of storage space.

Most of the available space numbers were obtained from worksheets submitted by the sites in response to the IDA data call. They include existing space plus anticipated new construction by 2000. Other data were obtained from References [3 and 4]. These data were supplemented with earlier cost estimates developed by Blount Island and information gathered during visits by the project team to each of the sites.

Relocation of Blount Island to Charleston would require, in addition to buildings needed to maintain the shipboard ground equipment, additional buildings for maintaining AGSE and NSE, neither of which are currently maintained at Charleston.

As a point of interest, although both sites have roughly the same total amount of building space available for ground equipment (602,100 and 568,000 square feet at Charleston and Blount Island, respectively), they use that space in different ways. The Army needs more maintenance space because of its larger numbers of tracked and wheeled vehicles, and the Marine Corps needs more storage space to handle its larger number of containers.

Table II-3. Construction of Buildings for Collocation, Single-Shift Operation

	Collocation at Charleston					Collocation at Blount Island				
	Space			Cost		Space			Cost	
	Available	Required	Additional	Rate ^a	Total	(in thousands of square feet)	Required	Additional	Rate ^a	Total
				(in FY 1997 dollars)	(Millions)				(in FY 1997 dollars)	(Millions)
Administrative										
Ground Equipment	62.5	136.5	74.0	—	—	74.0	136.5	62.5	—	—
AGSE	—	2.0	2.0	—	—	2.0	2.0	—	—	—
NSE	—	—	—	—	—	—	—	—	—	—
Total	62.5	138.5	76.0	\$142	\$10.8	76.0	138.5	62.5	\$142	\$8.9
Maintenance										
Ground Equipment	328.1	555.8	227.7	—	—	227.7	555.8	328.1	—	—
AGSE	—	20.8	20.8	—	—	20.8	20.8	—	—	—
NSE	—	—	—	—	—	—	—	—	—	—
Total	328.1	576.6	248.5	\$136	\$33.8	248.5	576.6	328.1	\$136	\$44.6
Storage										
Ground Equipment	211.5	376.3	—	—	—	266.3	376.3	—	—	—
AGSE	—	26.7	—	—	—	26.7	26.7	—	—	—
NSE	—	32.0	—	—	—	32.0	32.0	—	—	—
Total	211.5	435.0	100.0 ^b	\$92	\$9.2	325.0	435.0	100.0 ^b	\$92	\$9.2
Grand Total	—	—	—	—	\$53.8	—	—	—	—	\$62.7

^a Adjusted from Reference [5]. See text.

^b PSCC estimate. See text.

Maintenance philosophy is another source of difference in space usage. The Army plans to give each wheeled vehicle a complete technical inspection and preventive maintenance. The Marine Corps treats wheeled vehicles similarly if they have been used in exercises or contingencies during the deployment or if they have historical patterns of failure. Otherwise, vehicles are given only limited technical inspections, and sampling is used to discover new failure patterns.

The rates in Table II-3 are cost factors obtained from the US Army Cost and Economic Analysis Center [5]. These factors were adjusted to FY 1997 constant dollars using the DoD inflation factor for Family Housing and Military Construction. The three categories of construction used were General Purpose Maintenance Shops (Facility Category Group, or FCG F21885), Enclosed Storage Facilities, Installation (FCG F44180), and Administrative Facilities (FCG F6000).

The totals in the table are the additional space multiplied by the rates.

Table II-4 shows the calculations for a double-shift operation. With a double shift, the Army and Marine Corps could share maintenance facilities but not storage and administrative space. Note that single-shift operation costs \$31 million more in facilities than double-shift (\$53.8 million minus \$22.8 million and \$62.7 million minus \$31.7 million for collocation at Charleston and Blount Island, respectively). Later, we combine these figures with shift differentials in the contractor workforce costs.

In a sensitivity analysis, we calculated needs for additional storage space by subtracting available from required space rather than using PSCC's estimate. Table II-5 shows that the increased storage cost for single-shift operation is \$11.4 million for collocation at Charleston but only \$0.9 million at Blount Island. The difference is large enough to give Blount Island the lower cost: adding \$11.4 million and \$0.9 million to the total costs in Table II-3 (\$53.8 million and \$62.7 million) yields total costs for buildings of \$65.2 million and \$63.6 million, respectively. The same reversal occurs in Table II-4, for double-shift operation.

Our analysis indicates that under either a single- or double-shift operation, it would cost close to \$10 million less to collocate at Charleston rather than Blount Island. However, as shown in Table II-5, this conclusion depends to a large extent on the estimate of additional storage space to meet Blount Island's needs.

Table II-4. Construction of Buildings for Collocation, Double-Shift Operation

	Collocation at Charleston					Collocation at Blount Island				
	Space (in thousands of square feet)			Cost (in FY 1997 dollars)		Space (in thousands of square feet)			Cost (in FY 1997 dollars)	
	Available	Required	Additional	Rate ^a	Total (Millions)	Available	Required	Additional	Rate ^a	Total (Millions)
Administrative										
Ground Equipment	62.5	136.5	74.0	—	—	74.0	136.5	62.5	—	—
AGSE	—	2.0	2.0	—	—	2.0	2.0	—	—	—
NSE	—	—	—	—	—	—	—	—	—	—
Total	62.5	138.5	76.0	\$142	\$10.8	76.0	138.5	62.5	\$142	\$8.9
Maintenance										
Ground Equipment	328.1	328.1	—	—	—	227.7	328.1	100.4	—	—
AGSE	—	20.8	20.8	—	—	20.8	20.8	—	—	—
NSE	—	—	—	—	—	—	—	—	—	—
Total	328.1	348.9	20.8	\$136	\$2.8	248.5	348.9	100.4	\$136	\$13.6
Storage										
Ground Equipment	211.5	376.3	—	—	—	266.3	376.3	—	—	—
AGSE	—	26.7	—	—	—	26.7	26.7	—	—	—
NSE	—	32.0	—	—	—	32.0	32.0	—	—	—
Total	211.5	435.0	100.0 ^b	\$92	\$9.2	325.0	435.0	100.0 ^b	\$92	\$9.2
Grand Total	—	—	—	—	\$22.8	—	—	—	—	\$31.7

^a Adjusted from Reference [5]. See text.

^b PSCC estimate. See text.

**Table II-5. Total Cost for Alternative Storage Requirements
(Costs in FY 1997 Dollars)**

	Single Shift		Double Shift	
	Charleston	Blount Island	Charleston	Blount Island
Additional storage (sq. ft.)	100,000	100,000	100,000	100,000
Alternative additional storage (sq. ft.)	223,500	110,000	223,500	110,000
Increased additional storage (sq. ft.)	123,500	10,000	123,500	10,000
Rate (per square foot) ^a	\$92	\$92	\$92	\$92
Increased storage cost (millions)	\$11.4	\$0.9	\$11.4	\$0.9
Building total cost (millions)	<u>\$53.8</u>	<u>\$62.7</u>	<u>\$22.8</u>	<u>\$31.7</u>
<i>Total (millions)</i>	<i>\$65.2</i>	<i>\$63.6</i>	<i>\$34.2</i>	<i>\$32.6</i>

^a Adjusted from Reference [5]. See text.

E. MOVEMENT OF PERSONNEL, EQUIPMENT, AND FACILITIES

This section considers the expenses of moving government personnel (military and civilian) and equipment and facilities ("things") from the losing to the gaining site. There are no costs of moving contractors on grounds that military retirees with specialties in maintenance form a mobile and trained workforce on the East Coast. Tables II-6 and II-7 present the costs for moving personnel and things from Blount Island to Charleston, and Tables II-8 and II-9 deal with the reverse case.

**Table II-6. Cost of Moving Personnel for Collocation at Charleston
(Costs in Thousands of FY 1997 Dollars)**

Personnel Type	Number of Personnel	Cost per Person	Total Cost
Officers	10	\$7.4	\$74
Enlisted	51	\$4.3	\$218
Civilian	<u>46</u>	<u>\$32.0</u>	<u>\$1,474</u>
<i>Total</i>	<i>107</i>	<i>—</i>	<i>\$1,766</i>

The costs for moving personnel were obtained by multiplying numbers of government personnel by the costs per person. We assumed that two-thirds of the Marine Corps authorized military strength could be relocated as part of normal rotation and advance planning and would therefore require no moving expenses. The Army plans to use only two military personnel, and we assumed both would be moved. Both commands gave us their personnel figures, which were adjusted as described in the analysis of the government workforce in Chapter III, Section A. The formation of a joint command

requires the relocation of 46 civilian personnel from either site. Their individual relocation cost is much higher than that of the military, as is shown below.

**Table II-7. Cost of Moving Things for Collocation at Charleston
(Thousands of FY 1997 Dollars)**

Equipment/Facility Type	Labor	Material	MTMC	Other	Total
Material operations (shop) equipment	\$650	\$400	\$708	—	\$1,758
Storage racks	\$120	\$20	\$132	—	\$272
Transportation Movement Office containers	\$118	—	\$2,150	—	\$2,268
PP&P	\$60	\$8	\$20	—	\$88
Maintenance operations tools	\$135	\$11	\$83	—	\$229
Supplies	\$44	\$5	\$5	—	\$54
NSE (70 craft)	\$144	\$5	—	\$780	\$929
Equipment and supplies	\$176	\$6	—	—	\$182
Equipment and supplies for building TA56	\$1	—	—	—	\$1
Naval Repair Complex supplies and equipment	\$480	\$12	\$53	\$11	\$556
Operations support of equipment and tools	\$100	\$5	\$16	—	\$120
Vehicles and heavy equipment	\$250	\$5	\$450	—	\$705
Computer equipment	\$120	\$150	—	\$5	\$275
Wash rack	—	—	—	\$96	\$96
Scale house	—	—	—	\$6	\$6
Mod office equipment	—	—	\$33	\$220	\$253
Oil recovery tank	—	—	—	\$11	\$11
Crane	—	—	—	\$1,500	\$1,500
Site preparation	—	—	—	—	—
AGSE equipment and supplies	\$338	\$95	\$397	—	\$829
Clamshells (3)	—	—	—	\$464	\$464
<i>Total</i>	\$2,736	\$722	\$4,029	\$3,093	\$10,596

Notes: AGE = Air-Ground Support Equipment; MTMC = Military Traffic Management Command; NSE = Naval Support Equipment; and PP&P = Packaging, Packing, and Preservation.

**Table II-8. Cost of Moving Personnel for Collocation at Blount Island
(Costs in Thousands of FY 1997 Dollars)**

Personnel Type	Number of Personnel	Cost per Person	Total Cost
Officers	2	\$7.4	\$14.8
Enlisted	—	—	—
Civilian	46	\$32.0	\$1,474
<i>Total</i>	48	—	\$1,488

**Table II-9. Cost of Moving Things for Collocation at Blount Island
(Thousands of FY 1997 Dollars)**

Equipment/Facility Type	Labor	Material	MTMC	Other	Total
Material operations (shop) equipment	\$650	\$400	\$708	—	\$1,758
Storage racks	—	—	—	—	—
Transportation Movement Office containers	—	—	—	—	—
PP&P	—	—	—	—	—
Maintenance operations tools	\$54	\$11	\$83	—	\$148
Supplies	\$44	\$5	5	—	\$54
NSE (70 craft)	—	—	—	—	—
Equipment and supplies	—	—	—	—	—
Equipment and supplies for building TA56	—	—	—	—	—
Naval Repair Complex supplies and equipment	—	—	—	—	—
Operations support of equipment and tools	\$16	\$5	\$16	—	\$36
Vehicles and heavy equipment	—	—	—	—	—
Computer equipment	\$120	\$150	—	\$5	\$275
Wash rack	—	—	—	\$96	\$96
Scale house	—	—	—	\$6	\$6
Mod office equipment	—	—	\$33	\$220	\$253
Oil recovery tank	—	—	—	\$11	\$11
Crane	—	—	—	—	—
Site preparation	—	—	—	—	—
AGSE equipment and supplies	—	—	—	—	—
Clamshells (3)	—	—	—	\$464	\$464
<i>Total</i>	\$884	\$571	\$845	\$802	\$3,101

Notes: AGE = Air-Ground Support Equipment; MTMC = Military Traffic Management Command; NSE = Naval Support Equipment; and PP&P = Packaging, Packing, and Preservation.

The costs for moving officers and enlisted personnel for collocation at Charleston are \$7,400 and \$4,300, respectively (Table II-6). These figures reflect Permanent Change of Station (PCS) rates obtained from the Army Cost Factors Handbook (version 96.0). The \$32,000 rate for civilians is the figure in the Cost of Base Realignment Actions (COBRA) model used for BRAC actions. Moving civilians is much more costly than moving military personnel because civilians are allowed reimbursements for travel and closing costs on homes.

We based expenses for moving things to Charleston (Table II-7) on a Marine Corps estimate of \$11.9 million. The inland transportation costs were removed because Charleston has enough trucks to move the Marine Corps equipment from the wharf to the work centers. The costs for the Military Traffic Management Command (MTMC), the third column, include port handling and stevedoring costs. Total adjustments came to \$1.3 million less than the Marine Corps estimate.

The size of Blount Island work centers were used to estimate the costs of moving the Army to Blount Island (Table II-9). Work center costs were modified to fit within a 20% range (plus and minus 10%) of the average.

Movement of things costs less for collocation at Charleston (\$10.6 versus \$3.1 million) because the Army does not have analogous equipment to Blount Island's AGSE and NSE equipment—over a thousand containers and the large wharf crane, which alone would cost \$1.5 million to move. If organic transportation were not available at Charleston, moving the Marine Corps equipment from the wharf to the work sites could add another \$449,000 to the movement estimate.

Movement of personnel, however, costs approximately the same for collocation at the two sites (\$1.5 versus \$1.8 million) because most of the cost is for moving civilians and they number about the same at the two sites.

For a sensitivity analysis, we used the Marine Corps estimate of \$11.9 million without modification for the costs of moving things from Blount Island to Charleston. That total is \$1.3 million more than the \$10.6 million total in Table II-7.

F. BLOUNT ISLAND OWNERSHIP

The Marine Corps Blount Island maintenance facility is located on land that is currently leased from Gate Maritime Properties, Inc. There are other ports on Blount Island, but these are part of the Jacksonville Port Authority. The Marine Corps lease is up in 2004, but the Marine Corps has been asking for DoD and congressional authority to buy the site now. The lease payments are approximately \$11 million annually, with slight rises over time. Although it is impossible to predict the results of possible future negotiations, if the purchase price is anywhere near \$90 million, the estimate current at the time of the analysis, it would clearly save money over the long run (8 years or more) to buy the site, *providing planners eventually decide in favor of separate siting or collocation at Blount Island*. We have therefore included \$90 million for buying the site in those two options (Table II-10). (The \$90 million purchase would include some additional acreage not currently under lease for future expansion.)

Table II-10. Cost of Blount Island Ownership
(Millions of FY 1997 Dollars)

	Separate Siting			Collocation	
	CHS	BI	Total	at CHS	at BI
Blount Island purchase (year 2000)	—	\$90	\$90	—	\$90
Blount Island lease termination (year 2000)	—	—	—	\$37.6	—
<i>Total</i>	—	\$90	\$90	\$37.6	\$90

Note: Lease termination is present value (\$FY97) of \$11 million annually from 2000 to 2004.

As a separate matter, it is not true that a decision to collocate at Charleston would save all future costs for land at Blount Island. Although the lease contains no termination clause, we nevertheless assumed that Gate Maritime would require money to terminate the lease early. In particular, we assumed that the owner would ask for 4 years of lease payments to terminate at 2000, which would amount to a present-value cost of \$37.6 million in 1997.

To repeat the policy implications of this discussion concerning the purchase of Blount Island: The statement that DoD should buy Blount Island rather than continuing to lease it is contingent on a decision to allow the Marines to stay there (under either separate siting or collocation at Blount Island). It is *not* an argument for choosing either of these two options in the first place. That choice should depend on the total costs of the three options, including collocation at Charleston for which buying Blount Island disappears as an issue (unless DoD should want the land for another purpose).

G. PERSONNEL TRANSITION

Collocation would not occur overnight. Capital items and government workers would have to be moved, and some new contractors would have to be hired and trained. Although we have included estimates of what these activities would cost, there is no surety that maintenance operations would not be disrupted during the transition. The move can be planned in advance, but it is reasonable to expect that collocating two large maintenance sites would be accompanied by some disruption. Any interruption of operations could be serious if the collocation happened to occur during a contingency.

One way to minimize the possibility of disruption is to plan to maintain the workforce at the losing site during the transition period. This would hedge against the possibility that equipment could not be moved to the gaining site quickly enough to effect a seamless shift of operations. With this in mind, we calculated that personnel costs to maintain the government and contractor workforces at the losing site for 3 months of

simultaneous operation would be \$13.2 million for collocation at Charleston and \$8.3 million for collocation at Blount Island. Collocating at Charleston would cost more because the government workforce is larger at Blount Island.

III. ANNUAL COSTS

A. GOVERNMENT WORKFORCE

The government workforce at both sites includes both military and civilian personnel. These people manage the afloat prepositioning maintenance programs. We did not include government personnel who support the sites but are not employees of the Army or Marine Corps prepositioning commands. Examples are personnel who work for the Military Traffic Management Command and military police who work under an Inter-Service Support Agreement.

1. Separate Siting

According to figures obtained from the data call and shown in Table III-1, Blount Island has a much larger government workforce than Charleston. We adjusted the Charleston workforce because of Blount Island's much longer experience. Whereas the Marine Corps has operated afloat prepositioning forces since 1985, the Army site at Charleston has come on line only recently and might not be fully operational for several years. At the time of analysis for this study (late 1996), the site had yet to complete a full cycle of operations with the entire fleet. We therefore relied on Blount Island's experience and used the size of its government workforce to estimate the year 2000 workforce at both sites (a mirror costing assumption in the case of Charleston). The two sites perform similar maintenance functions, and will be responsible for maintaining roughly the same amount of annual cargo in 2000.

We separated the current government staffing at Blount Island into those people who manage functions unique to the Marine Corps and the remainder—a "core" workforce that manages maintenance of the ground prepositioning equipment and other non-unique tasks. This core workforce was used to estimate the year 2000 workforce for Charleston in Table III-2. (Charleston performs no Army-unique functions such as those performed at Blount Island specifically for the Marine Corps.)

Table III-1. Current Government Workforce

	CHS Organizational Element				BI Organizational Element			
	Command/ Admin.	Operations ^a	Logistics ^b	Total	Command/ Admin.	Operations ^a	Logistics ^b	Total
Military	1	—	—	1	23	20	67	110
Civilian	<u>20</u>	<u>2</u>	<u>25</u>	<u>47</u>	<u>16</u>	<u>3</u>	<u>38</u>	<u>57</u>
Total	21	2	25	48	39	23	105	167

^a Operations personnel are primarily involved in the ship scheduling and load planning functions.

^b Logistics personnel are primarily involved in oversight and quality control of the actual equipment maintenance activity.

Table III-2. Adjusted Size of Government Workforce in 2000

	Separate Siting			Collocation	
	CHS	BI	Total	at CHS	at BI
Service-unique personnel					
AGSE	—	22	22	—	—
NSE	—	6	6	—	—
Norway support	—	4	4	—	—
Support to deployed commands	—	<u>5</u>	<u>5</u>	—	—
Subtotal	—	37	37	—	—
Core maintenance personnel	<u>130</u>	<u>130</u>	<u>260</u>	—	—
Total personnel	130	167	297	0	0
Changes for collocation					
Savings	—	—	—	62	62
Moved for Joint Command	—	—	—	29	29
New hires for Joint Command	—	—	—	13	13
Final commands					
Army plus Marine Corps	—	—	—	206	206
Joint Command	—	—	—	<u>42</u>	<u>42</u>
Total	—	—	—	248	248

We assumed that future staffing at Blount Island would be somewhat larger than the current level because of the need to support the three new ships expected to be in the Marine Corps fleet by 2000. The unique functions performed at Blount Island include maintaining AGSE and NSE. In addition, under the Marine Corps's concept of operations, some of the Blount Island government personnel (civilians and military) directly support the CINCs by flying to foreign sites to supervise the offloading of prepositioned equipment during exercises and contingency operations. Other unique functions include participating in the Marine Corps ammunition maintenance program and supporting the Norway Prepositioning Program.

Table III-3 shows our estimates of the cost of the workforce adjusted for the year 2000.

Table III-3. Adjusted Cost of Government Workforce in 2000
(Millions of FY 1997 Dollars)

	Separate Siting			Collocation	
	CHS	BI	Total	at CHS	at BI
Service-unique personnel					
AGSE	—	0.52	0.52	—	—
NSE	—	0.28	0.28	—	—
Norway support	—	0.14	0.14	—	—
Support to deployed commands	—	<u>0.13</u>	<u>0.13</u>	—	—
Subtotal	—	1.07	1.07	—	—
Core maintenance personnel	<u>4.08</u>	<u>4.14</u>	<u>8.22</u>	—	—
Total personnel	4.08	5.21	9.29	—	—
Changes for collocation					
Savings	—	—	—	1.99	1.99
Moved for Joint Command	—	—	—	1.16	1.16
New hires for Joint Command	—	—	—	0.48	0.48
Final commands					
Army plus Marine Corps	—	—	—	6.20	6.20
Joint Command	—	—	—	<u>1.64</u>	<u>1.64</u>
Total	—	—	—	7.74	7.74

Our estimate of a core workforce of 130 people (Table III-2) is substantially larger than the current government workforce at Charleston (Table II-1; the mirror costing assumption). Charleston officials disagreed with this estimate, and stated that their current staffing level would be adequate to support future operations. Although the issue involves considerable uncertainty, we nevertheless believe that equal core workforces is a reasonable assumption.

2. Collocation

We constructed the personnel and costs of the collocated workforce from the figures for separate siting in these steps:

1. Eliminate billets for functions that would not have to be performed by both core forces at a collocated site.
2. Transfer some of the core personnel to a new Joint Command created for command and control at the gaining site.
3. Fill the remaining Joint Command billets with several new hires.

The eliminated billets were determined by identifying functions in the Blount Island Table of Organization (Table III-4) that would not be required for both core workforces at a collocated site. We checked our assumptions in this regard through

interviews with senior people at the two commands. The costs of the final workforces were obtained by applying average annual pay rates for the various military and civilian grades.

Table III-4. Organizational and Functional Taxonomy

Headquarters ^a	Operations ^b
Command	Headquarters
Accounting/Finance	Cargo Operations
Administration	Embarkation
Contracting	Information Systems
Environmental Compliance	Planning
Logistics Planning	Logistics ^c
Medical	Headquarters
Personnel Administration	Automotive Management
Purchasing	Communications/Electronics
Safety Monitoring	Container Management
Security	Ground Support
Supply	Medical Management
Training	Ordnance Management
	Supply

^a Headquarters personnel perform command and overall administration.

^b Operations personnel manage ship scheduling and loading.

^c Logistics personnel plan and oversee the actual maintenance.

3. Joint Command

The collocated site was provided with a Joint Command on grounds that (1) savings on cost, the principal aim of collocation, would require sharing of resources, and (2) an over-arching command would be needed to ensure sharing of resources by two autonomous commands representing two different Services. An Executive Agent could also serve as the over-arching command, but the difference in cost from the Joint Command would not be large enough to affect the study's findings.

The Joint Command structure we postulated, shown in Figure III-1, accords with the doctrine and policy guidance for such commands in JCS Joint Publication 0-2, 24 February 1995. The billets marked with asterisks in the figure were filled through personnel transfers from the Army and Marine Corps prepositioning commands at the sites. We limited these transfers to billets involving such tasks as managing the use of ports and other common resources, functions that would clearly require liaison and coordination between the two commands.

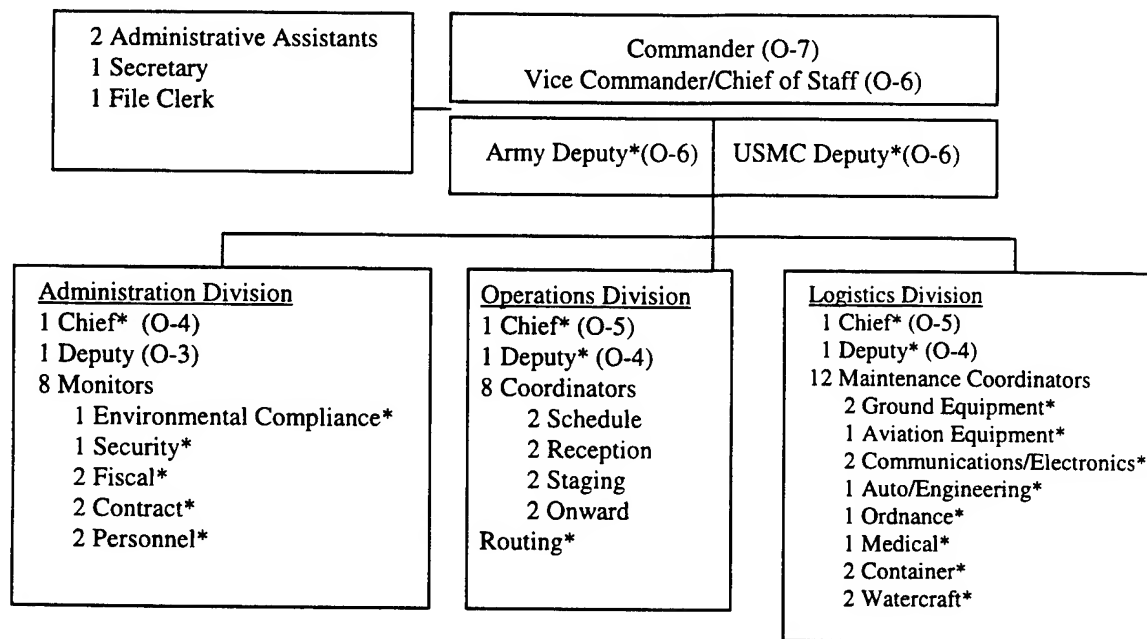


Figure III-1. Structure of Postulated Joint Command

The remaining Joint Command billets were obtained through new hires or transfers from other Service commands. Some existing billets were eliminated. (We did not eliminate billets that could be used by the Joint Command.) As Figure III-1 shows, we postulated a relatively small Joint Command headed by a one-star officer. Of the total of 42 billets, 29 are transfers from the two prepositioning maintenance commands (identified by asterisks) and another 13 (including the Commander and Vice Commander) are new hires or transfers from other commands.

We assumed that the Joint Command would be subordinate to a unified command, probably the Transportation Command. The Joint Command would be located at the collocated site and, as mentioned previously, participate in functions requiring liaison and the use of common resources: coordinating cargo maintenance with ship arrivals and departures, assigning berths, scheduling loading operations, routing cargo to and from the maintenance sites, and coordinating security of the site.

Apart from these functions that clearly involve joint use of the site, the two Services would continue to manage their maintenance programs as they do now. Marine Corps Headquarters and the Army Material Command (AMC) would continue working with the supported CINCs to set equipment objectives and maintenance requirements.

The Marine Corps Supply Center at Albany, Georgia, and AMC would continue to set the cargo maintenance cycles and operations.

4. Summary

Table III-5 shows the net impact on the government workforce of the reductions to eliminate duplication and the new hires for the Joint Command. The 295 billets under separate siting falls to 246 billets, a reduction of 17%. The reduction in the Army and Marine Corps commands themselves (ignoring the 42 billets for the Joint Command), would be even larger, a 31% reduction from 295 to 204 billets. Finally, if we leave out the 39 billets for the unique Marine Corps functions, for which no savings were estimated, the combined core workforces fall from 256 to 165, a saving of 36%.

Table III-5. Summary of Government Workforce

	<u>Current</u>	<u>After Collocation</u>	<u>Percentage Change</u>
Marine Corps-unique personnel	37	37	—
Army plus Marine Corps core personnel	260	169	-35%
<i>Total</i>	<u>297</u>	<u>206</u>	-31%
Joint Command	—	<u>42</u>	—
<i>Grand Total</i>	297	248	-17%

The results of the government workforce analysis are shown in Table III-6.

**Table III-6. Annual Cost of Government Workforce
(Millions of FY 1997 Dollars)**

<u>Separate Siting</u>			<u>Collocation</u>	
<u>CHS</u>	<u>BI</u>	<u>Total</u>	<u>at CHS</u>	<u>at BI</u>
\$4.1	\$5.2	\$9.4	\$7.9	\$7.9

B. CONTRACTOR WORKFORCE

Both prepositioning sites employ contractors for hands-on maintenance. These workforces perform preventive and corrective maintenance on the prepositioned equipment, which includes tracked and wheeled vehicles, engineering equipment, and electronics items. The workforces also process containerized items by swapping out outdated Meals Ready To Eat (MREs) and medical supplies. These hands-on maintenance activities require additional contractors for logistics support: parts must be

ordered, shipments must be processed, and the material must be warehoused. There are also overhead costs for personnel support, computer processing, and training.

The contractor workforces at Blount Island and Charleston perform several additional tasks for maintaining the prepositioning ground equipment. We assumed that these additional tasks, listed below, would be performed without change under collocation, so the costs of these tasks would also not change. The costs are, however, included in the totals.

1. Blount Island personnel maintain AGSE and the Navy's entire lighterage program (NSE). The NSE equipment is maintained under a subcontract to the large contract for maintaining the shipboard equipment. The AGSE equipment is maintained under a separate, smaller contract.
2. Some Charleston and Blount Island personnel sail on the Army and Marine Corps prepositioning ships in order to perform routine maintenance on the shipboard equipment.
3. Some Blount Island personnel deploy to foreign sites to assist in offloading equipment during training exercises and contingencies. Contractors are not involved, however, in the Marine Corps-unique function of managing the brigade of Marine equipment stored in Norway.

This section focuses on the labor costs alone. For convenience, we use the term "contractor workforce" for these costs in this section.

1. Separate Siting

To protect the proprietary interests of the contractor organizations, we do not discuss in great detail the costs of the contractor workforce at Blount Island in 2000 under separate siting. The numbers of people in the Blount Island workforce in the year 2000 were estimated by adjusting the current workforce to account for changes in workload due to the coming addition of three new ships. The personnel costs were obtained by multiplying the staffing figures by wage rates and allowances for overtime, overhead, and profit and fee. We supplemented these figures with a variety of other data: invoice data by work-unit code for 1994 and 1995, ship loading plans, Department of Labor wage scales for the Charleston and Jacksonville areas, and man-hour standards for annual preventive maintenance of tracked and wheeled vehicles.

Because of the Charleston site's newness, we estimated the costs of its workforce in 2000 by adjusting Blount Island costs, a "mirror costing" approach. For example, we applied Blount Island labor costs per tracked vehicle to the numbers of these items

expected at Charleston in 2000. Similar calculations were made for wheeled vehicles, containers, and other items.

This assumption of equal labor costs per item at the two sites depends, in turn, on assumptions of

- equal labor hours per item and
- equal labor cost per labor hour.

The labor hours per item were assumed equal on grounds that the Army and Marine Corps use similar vehicles and containers. The assumption of equal labor cost per labor hour is based on current Department of Labor data that show similar labor rates (cost per hour) for similar occupations in the Charleston and Jacksonville areas. We assumed that these rates for maintenance personnel will continue to remain similar at the two sites in the future. Personnel at both sites stated that Service retirees with maintenance backgrounds along the Southeastern seaboard constitute a large and mobile labor pool. Competition is another factor that should stabilize rates.

2. Collocation

Collocation can save on contractor costs through economies of scale. These savings depend substantially on whether the maintenance operation is single or double shift, and we did calculations for both. In a double-shift operation, the workforce would be able to use the same facilities currently at the gaining site, with some additions described in the previous chapter. Under a single-shift operation, however, substantial additional facilities would be required at the gaining site so that both workforces could be employed simultaneously. Both operations were analyzed because it was not obvious, at first, which option would be more efficient. A single-shift operation would cost more in facilities, but a double-shift operation would suffer from additional management and supervisory costs and efficiency losses.

To estimate the savings under collocation, we needed detailed information about types of labor. The following list describes the categories in our approach to collocation savings.

1. *Direct labor.* These are the people who perform the hands-on maintenance. The numbers and types of direct-labor people are closely tailored to the maintenance workload and would thus be unaffected by collocation except for a reduced need for overtime.

2. *Supervisory, management, and administrative personnel.* Collocation can save on personnel who perform these functions because of a fixed component in the number needed to support direct labor. If Charleston and Blount Island each needed only one person to supervise maintenance of HMMWVs, for example, collocation could halve the number of such personnel. There might also be savings in computer administrative personnel.
3. *Shipboard labor.* These are the contractor personnel who deploy on the prepositioning ships and fly to foreign exercise and contingency areas. The number of these people would not be expected to change under collocation, and their labor costs were thus held constant.
4. *Materials and subcontracts.* While not included in the sites' workforce costs, this category was included in future contractor budgetary data. No reductions in collocation were assumed.
5. *Equipment movement from port to maintenance areas.* Contractors perform this task at Charleston and Blount Island. The distances are different at the two sites, which leads to different costs under collocation.
6. *Marine Corps-unique functions.* We assumed that collocation would not affect the maintenance of the AGSE and NSE equipment. (Contractors are not used to support the Marine Corps Norway brigade, another unique Marine Corps function.)

We calculated the contractor savings under collocation by applying the factors shown in Table III-7 to the number of people in items 2 and 5 above, the personnel categories that would change with collocation. The items in Table III-7 that are not self-explanatory are explained below:

- Item 2 The 75% reduction in the number of management and administrative personnel at the losing site reflects the fact that many management and administrative functions have a strong fixed component, independent of the number of people they serve.
- Item 4 The longer distance from port to maintenance area at Charleston means that more labor hours would be required for driving and security for the rail and road convoys. Data in Reference [6] suggests that compared to the labor involved in separate siting, there would be an extra 12 man-years of effort per year for driving and security if the Marine Corps relocated to Charleston, and a savings of 12 man-years if the Army relocated to Blount Island.

Table III-7. Factors Used for Analyzing Contractor Workforce Savings

Type of Operation	Description	Value	Notes
Single or double shift	1. Work hours per year	1,900	52 weeks × 40 hours per week less holidays, vacation, and sick leave
	2. Savings of management and administrative personnel	75%	Percentage of management and administrative billets saved at the losing site by collocation
	3. Fee	6%	Profit or award fee percentage
	4. Direct labor people involved in transporting equipment from port to maintenance area	10 miles at Charleston; negligible at Blount Island	
	5. Percentage of overtime reduction	55% for single shift, 50% for double shift	
Single shift only	6. Percentage of regular shift time required for overtime	3.5%	Calculated from data call; excludes personnel not involved with collocation savings
	7. Percentage of production supervisor billets saved from the smaller workforce for a single-shift operation	75%	
Double shift only	8. Minutes of lost time per 8-hour shift for passing work to the next shift	40	20 minutes at beginning and end of each shift to receive and record information
	9. Percentage of total workforce on second shift	48%	Based on discussions with the contractors
	10. Percentage of shift productivity lost because of circadian factors.	5%	
	11. Supply worker savings with second shift	10%	The percentage reduction in number of second-shift supply workers (shipping and receiving) for a double-shift operation
	12. Percentage increase in pay for second-shift work	2.9%	Based on an evening shift pay differential of \$0.35 per hour

- Items 5 & 6 Collocation would save on overtime pay by providing more opportunities to take advantage of fluctuations in workload. For example, if workers at Blount Island need help in meeting a deadline when workers at Charleston have extra time, collocation would eliminate the need for overtime, assuming that sharing arrangements are made.
- Item 8 A double-shift operation leads to some reduction in output because workers need some time to pass off work to people who would be working on the same items in the following shift.
- Item 10 A double-shift is less efficient because of biological (circadian) factors associated with night work.
- Item 11 A day-shift supply department can handle the shipping and receiving functions of both day and night shifts.
- Item 12 A double-shift operation bears an added cost in requiring a pay differential to compensate people for the inconvenience and unpleasantness of night work.

3. Summary

Table III-8 shows the costs of the contractor workforces under the various siting options, assuming single-shift operation. The materials costs shown in the table, taken from the data call, are for the spares and repair parts that the contractors buy directly from private supply houses. (The spares and repair parts that the workforces obtain from the DoD supply system are considered in Section D of this chapter.) Because collocation would not affect the maintenance workload, it would also have no effect on the costs of materials, and we accepted the figures derived from the data call shown in Table III-8. We did not, for example, seek to determine the reason for the disparity between the Charleston and Blount Island figures. The total costs shown in Table III-8, which include materials, are reported under "Contractor Workforce" in the summary in Chapter I (Table I-2).

**Table III-8. Annual Cost of Contractor Workforce
(Millions of FY 1997 Dollars)**

	Separate Siting			Collocation (Single-Shift)	
	CHS	BI	Total	at CHS	at BI
Labor	\$27.40	\$28.90	\$56.31	\$50.60	\$49.56
Materials	<u>\$1.81</u>	<u>\$18.49</u>	<u>\$20.30</u>	<u>\$20.30</u>	<u>\$20.30</u>
<i>Total</i>	\$29.21	\$47.39	\$76.61	\$70.90	\$69.86

The final results of the contractor analysis, the labor analysis previously described plus the contractor materials cost in Table III-8, are presented in Table III-9. The costs under collocation were calculated by subtracting savings from the costs under separate siting. The figures in Table III-8 indicate that under a single-shift operation, collocation at Charleston or Blount Island could save \$5.7 million to \$6.7 million in contractor costs, respectively (\$76.6 million minus \$70.9 million; \$76.6 million minus \$69.9 million). There are no savings for a double-shift operation. In fact, collocation at Charleston would cost \$1 million *more* than separate siting. Collocation at Blount Island would cost virtually the same as separate siting. Later, we discuss the *net* savings of the single-shift operation, given the added cost of facilities mentioned in the earlier Section D in Chapter II on facility military construction.

**Table III-9. Contractor Workforce Analysis
(Millions of FY 1997 Dollars)**

Cost Category	Labor Costs		Materials	Total Costs	
	Single-Shift Operation	Double Shift-Operation		Single-Shift Operation	Double Shift-Operation
Costs for separate siting					
Charleston	\$27.40	\$27.40	\$1.18	\$29.21	\$29.21
Blount Island	<u>\$28.90</u>	<u>\$28.90</u>	<u>\$18.49</u>	<u>\$47.39</u>	<u>\$47.39</u>
Total	\$56.31	\$56.31	\$20.30	\$76.61	\$76.61
Savings for collocation at:					
Charleston					
Workforce	\$6.20	<u>\$-0.48</u>	—	—	—
Transport from wharf	<u>\$-0.50</u>	<u>\$-0.50</u>	—	—	—
Total	\$5.70	\$-0.98	—	—	—
Blount Island					
General workforce	\$6.20	\$-0.48	—	—	—
Transport from wharf	<u>\$0.55</u>	<u>\$0.55</u>	—	—	—
Total	\$6.75	\$0.07	—	—	—
Total costs for collocation at:					
Charleston	\$50.60	\$57.28	\$20.30	\$70.90	\$77.58
Blount Island	<u>\$49.56</u>	<u>\$56.23</u>	<u>\$20.30</u>	<u>\$69.86</u>	<u>\$76.53</u>

Table III-10 shows the sensitivity of the contractor labor costs to two uncertain factors we felt could have a major effect on collocation savings: the reductions in the size of the support staff (management and administrative personnel) and the overtime costs. The higher and lower values for these factors were based on a literature review and discussions with government and contractor personnel at the two sites.

**Table III-10. Annual Cost of Contractor Workforce
(Millions of FY 1997 Dollars)**

	Separate Siting	Collocation at CHS		Collocation at BI	
		Single Shift	Double Shift	Single Shift	Double Shift
Base case	\$56.31	\$50.60	\$57.28	\$49.56	\$56.23
Overtime variation					
25%	\$56.31	\$50.98	\$57.63	\$49.93	\$56.58
75%	\$56.31	\$50.23	\$56.94	\$49.18	\$55.89
Support staff variation					
60%	\$56.31	\$51.54	\$57.77	\$50.49	\$56.72
90%	\$56.31	\$49.67	\$56.80	\$48.62	\$55.75

These sensitivity variations proved to have little effect on the costs of separate siting and collocation; thus, they had no effect on the major finding that collocation would save approximately \$6 million annually in contractor costs. More detailed results are that the variation in the support staff factor has a larger effect than the variation in the overtime factor. For collocation at Charleston in single-shift operation, the variation in the support staff factor changes costs by approximately a million dollars annually (\$51.54 million to \$50.60 million, or 2.6% of the cost of the base case) but only \$400 thousand annually (\$50.98 million to \$50.60 million, or 1.4% of the cost of the base case) for the overtime variation.

C. STEVEDORING

In this study, stevedoring refers to more than stowing cargo on ships. It includes loading and unloading the cargo (stevedoring in the narrow definition), rentals, dunnage (adding protective padding in ship's cargo), contractor labor, and wharf and dockage fees. The Military Traffic Management Command (MTMC) manages these functions at both sites.

The stevedoring costs reported by the two sites in the data call differed by a factor of 3, far more than the difference in planned maintenance workloads for the year 2000. The two sites clearly used different accounting methods to calculate the costs. We therefore re-estimated stevedore costs at the two sites using similar assumptions. The remainder of this subsection describes the original estimates and our own calculations.

The stevedoring costs we obtained from the data call were \$10.5 million for Charleston and \$3.3 million for Blount Island. Blount Island obtains stevedoring labor

under a contract that MTMC negotiates and manages for Blount Island. The contract includes a surcharge of 10% for MTMC's services. The \$3.43 million estimate of Blount Island's 2000 stevedoring costs includes the expenses for the three new Marine Corps Maritime Prepositioning Force (MPF) Enhanced ships, which have somewhat larger capacities than the current Marine Corps ships.

Charleston obtains stevedoring services under a general-purpose stevedoring contract that MTMC negotiates and manages for all such activity at Charleston, South Carolina, and Savannah, Georgia, ports. MTMC was operating on a Defense Business Operations Fund (DBOF) basis in the Charleston area during the data-gathering phase of this study. Consequently, the stevedoring costs reported by Charleston in the data call include a charge for DBOF overhead, along with payments to the contractor and MTMC.

We met with MTMC headquarters personnel and officials from both sites in order to determine the source of the three-fold difference in costs at Charleston and Blount Island. The disparity proved to be caused by two factors:

- large differences in the stevedore commodity rates listed in MTMC contracts in the Charleston and Blount Island areas and
- the use of MTMC DBOF rates at Charleston.

The figures in Table III-11 document the higher costs in the Charleston area. The largest disparity is between the costs of loading an explosive cargo container: \$54 in the Jacksonville area versus \$243 in Charleston, a factor of over 4. Even the lowest factor in the table, 1.4, indicates a 40% differential at Charleston.

The next question is, why such a large disparity in the stevedoring rates? MTMC personnel said that they were able to negotiate lower commodity rates at Jacksonville for two principal reasons: more competition and greater predictability in workload. Stevedoring contracts in Florida permit use of non-union labor, but South Carolina supports a union shop. The present Blount Island stevedoring contractor currently uses only union labor, but the competition from a non-union bidder enabled MTMC to obtain the current low rates. And the stevedoring contractor at Blount Island deals with only a single customer, whereas the stevedoring contractor at Charleston services the Army prepositioning ships, Department of Energy ships, and Naval ammunition and combatant ships.

**Table III-11. Comparison of Stevedoring Contract Rates
(Costs in FY 1997 Dollars)**

Item	Average Rates ^a		Ratio
	Charleston	Jacksonville	
Explosive cargo container	\$243.10	\$53.69	4.5
Wheeled vehicles over 10,000 tons			
RO/RO drive on/off	\$70.53	\$20.21	3.5
RO/RO tow on/off	\$110.02	\$35.81	3.1
Wheeled vehicles under 10,000 tons			
RO/RO standard lashing	\$75.50	\$22.78	3.3
RO/RO drive on/off	\$27.61	\$11.83	2.3
RO/RO tow on/off	\$73.34	\$16.71	1.4
Tracked vehicles on Treads			
RO/RO drive on/off	\$64.59	\$30.61	2.1
RO/RO tow on/off	\$220.00	\$56.84	3.9
Cargo transporter	\$67.40	\$43.94	1.5
General cargo, pre-unitized	\$13.21	\$7.81	1.7

^a Charleston's average rate is for the "auto" ship category (RO/RO).

For purposes of the analysis, it was important to put the stevedoring costs of the two sites on a similar basis. This meant eliminating the confounding effect of the DBOF costs in the figures Charleston had provided. Simply subtracting the DBOF overhead rates from total costs was not possible because the rates could not be easily determined. We instead used the following method for estimating Charleston rates that exclude the DBOF influence. We started with the Blount Island cost estimate, a projection based on actual cost experience. We eliminated the MTMC cost component, calculated an average stevedoring cost for the Marine Corps ships, and then applied the unit cost to the number of Army ships. The results are in Table III-12.

**Table III-12. Calculation of Stevedoring Costs for Charleston in 2000
(Millions of FY 1997 Dollars)**

	Cost
Projected Blount Island annual stevedoring costs in 2000	\$3.30
Less MTMC 10% surcharge	\$3.00 ^a
Average cost per ship for 6.4 Marine Corps ships per year	\$0.47
Army "base" cost for 4.6 ships per year	\$2.16
Plus 20% cargo differential for Army ships	\$2.59
Plus 25% stevedoring contractor cost differential	\$3.24

^a \$3.30 million divided by 1.1 (the 10% surcharge is applied to the cost *less* the MTMC surcharge).

Our calculation used the following assumptions:

- Blount Island will handle 6.4 ships per year (sixteen ships divided by the 30-month maintenance cycle and multiplied by 12 months per year)
- Charleston will handle 4.6 ships per year (assuming a 30-month maintenance cycle for the eight new LMSRs and the one T-ACS and a 24-month maintenance cycle for the two containerships).
- The Army ships will carry 20% more cargo than the Marine Corps ships in 2000 (the Army brigades are heavier).
- Stevedoring contractor rates in the Charleston area will still be greater than in the Jacksonville area in 2000, but only by 25%.

There is obviously some uncertainty in our estimate that Charleston stevedoring rates would still be 25% higher than the Jacksonville rates in 2000. On one hand, there is reason to believe that the Charleston rates will fall from their currently high levels relative to the Jacksonville rates. If the Marine Corps co-located to Charleston, MTMC would likely negotiate an exclusive contract for the prepositioning programs and open it to competition. Contract rates would probably be substantially lower than the present figures since the successful bidder would be guaranteed a certain volume of business on a predictable schedule with a known cargo composition.

However, the MTMC personnel we talked to predicted that Charleston rates would still exceed those at Jacksonville because of persistence in differences in the labor markets in the two areas. Our assumption of a remaining 25% location differential between Jacksonville and Charleston in 2000 is a best guess at the resultant effect of these various factors.

Based on the figures outlined in Table III-12, we estimated stevedoring rates of \$3.2 million and \$3.0 million for Separate Siting at Charleston and Blount Island in 2000 respectively. The costs for collocation at Charleston, shown in Table III-13, were calculated by adding the Blount Island cost of \$3.0 million (increased by the assumed 25% location differential discussed above) to the Charleston cost of \$3.2 million. The cost for collocation at Blount Island would equal the \$3.0 million cost of separate siting at Blount Island, plus the \$3.2 million for separate siting at Charleston, divided by 1.25 to adjust for the location factor.

**Table III-13. Annual Cost of Stevedoring
(Millions of FY 1997 Dollars)**

Separate Siting			Collocation	
CHS	BI	Total	at CHS	at BI
\$3.2	\$3.0	\$6.2	\$7.0	\$5.6

D. SPARES AND REPAIR PARTS

This cost category refers to those spares and repair parts for maintaining prepositioning equipment that are bought through the DoD supply system. The costs for these items are shown in Table III-14. The spares and repair parts that are purchased directly by contractors from private supply houses are considered in the previous section on the contractor workforce.

**Table III-14. Annual Cost of Spares and Repair Parts
(Millions of FY 1997 Dollars)**

Separate Siting			Collocation	
CHS	BI	Total	at CHS	at BI
\$15.1	\$13.4	\$28.5	\$28.5	\$28.5

The figures in Table III-14 were obtained from the data call. The similarity in the costs under separate siting is plausible, given the similar maintenance workload at the two sites, both now and anticipated for 2000. And since these workloads would not change under collocation, neither would the costs. We therefore accepted these costs without further study. (We neglected to increase the costs in anticipation of the future increases in the Army and Marine Corps fleets, but the cost *savings* due to collocation would be unaffected.)

E. DEPOT COSTS: RECEIPT, REPAIR, AND PREPARATION FOR SHIPMENT

Some prepositioning items require depot-level maintenance in addition to the intermediate-level repair performed at Charleston and Blount Island. Blount Island sends items requiring depot-level repair to the Marine Corps Logistics Base (MCLB) at Albany, Georgia; Charleston sends its items to various installations. This cost category refers to the three activities involved in depot-level repair: receiving the items from Charleston or Blount Island, making repairs, and preparing the items for shipment back to Charleston or Blount Island. (The actual transportation costs are considered in the next section, Second Destination Transportation.) Although MCLB Albany's costs are not included in Blount

Island's budget, we included them because they are costs of maintaining Marine prepositioning equipment.

We accepted the figures that Charleston and Blount Island submitted in response to our data call (Table III-15) and did not study them further for the same reasons mentioned in the previous section.

**Table III-15. Annual Cost of Receipt, Repair, and Preparation for Shipment
(Millions of FY 1997 Dollars)**

	Separate Siting			Collocation	
	CHS	BI	Total	at CHS	at BI
Receipt and Preparation for Shipment	\$4.5	\$5.5	\$10.0	\$10.0	\$10.0
Repair	—	\$1.6	\$1.6	\$1.6	\$1.6
<i>Total</i>	\$4.5	\$7.1	\$11.6	\$11.6	\$11.6

Notes: Army reimbursement costs are included in the Charleston budget. Marine Corps reimbursement costs are not included in the Blount Island budget.

F. SECOND DESTINATION TRANSPORTATION

Second destination transportation refers to the annual expenses of shipping anything other than people to and from the prepositioning maintenance sites. It includes such things as ammunition, major end items, and spares and repair parts. The *one-time* costs of moving equipment from the losing to the gaining site in preparation for collocation is covered in Chapter II, Section E. The costs discussed here refer to the costs of annual maintenance.

The Blount Island costs under separate siting (Table III-16) are the figures received in the data call multiplied by 1.23 to account for the three new Marine Corps MPF Enhanced ships ($16 \div 13 = 1.23$). The costs for separate siting at Charleston are that command's estimate of expenses in 2000.

**Table III-16. Annual Cost of Second Destination Transportation
(Millions of FY 1997 Dollars)**

Type of Shipment	Separate Siting (Status Quo)			Collocation	
	CHS	BI	Total	at CHS	at BI
Marine Corps ammunition to Charleston	—	\$2.7	\$2.7	—	\$2.7
Marine Corps equipment to MCLB Albany	—	\$0.4	\$0.4	\$0.6	\$0.4
Army ammunition to Charleston	—	—	—	—	\$0.2
Army MRE to MCLB Albany	—	—	—	—	\$-0.3
All other shipments	\$1.7	\$1.8	\$3.5	\$3.5	\$3.5
<i>Total</i>	\$1.7	\$4.9	\$6.6	\$4.1	\$6.5

The Marine Corps response to the data call included the tonnages, origins and destinations, and costs for all trips of general cargo and ammunition. We used these extensive data to estimate the increase in transportation cost if the Marine Corps maintenance facility were relocated to Charleston.

The Army's second destination transportation data contained only the costs by major subordinate command. However, we were able to use other Army data submitted by Charleston (loading plans for the RO/RO ships, containerships, and crane ships, and data on containers and ammunition) to estimate the annual second destination transportation costs if the Army relocated to Blount Island.

The costs in Table III-16 are shown by type of transportation because of different treatment under collocation. For example, Marine Corps ammunition containers offloaded at Blount Island cannot be repaired there because of limitations on explosives. They are instead shipped by rail to NWS Charleston for maintenance. These transportation costs would clearly remain under collocation at Blount Island, but would disappear if the Army relocated to Charleston.

The Army's ammunition shipping costs would change under collocation at Blount Island because the ammunition coming off of the LSMRs would presumably still be shipped to NWS Charleston for maintenance. The cost, \$0.2 million annually, is much smaller than that for the current Marine shipments to the weapon station because most of the Army's prepositioned ammunition is carried on three dedicated ammunition ships to be maintained at the NWS at Concord, California.

The \$0.2 million estimate was derived using a MTMC estimate of approximately \$3,000 per flat car to ship ammunition by rail from Blount Island to NWS Charleston. Four containers are loaded on each flat car, yielding a cost of \$750 per container. The Army plans to maintain the cargo of three LMSRs a year. We assume these ships would carry the total of 229 containers now carried by the six RO/RO ships. The total cost of \$0.2 million is found by multiplying the cost per container by 229 containers and adding in \$2,700 (\$900 per ship-load times 3 ships) for guarding the ammunition during the rail travel.

Another large category of shipments from Blount Island, over 54% of total shipments, are items requiring depot-level repair that are shipped to MCLB Albany. Relocation to Charleston would increase the distance of these shipments by 63%, from 206 to 336 miles. Since rail costs are generally a function of distance, we increased the current rail costs by 63%, yielding a total increase of \$665,000 (\$0.6 million). We

assumed that the changes in cost to the other destinations would offset each other. (Some sites would be farther, others closer.)

The Army plans to maintain MREs at the Defense Logistics Agency installation at Albany, Georgia. The trip to Albany would be 130 miles shorter, and the transportation costs correspondingly less if the Army moved to Blount Island. There would be no change in cost for Marine MRE containers, since the Marine Corps would likely continue to maintain its own.

G. BOS AND RPMA

This section discusses base operations support (BOS) and real property maintenance activity (RPMA), two of the base maintenance functions listed in Table I-2. Other facility support, a set of miscellaneous functions that are not affected by collocation, are discussed in the next section.

BOS refers to housekeeping functions such as utilities, communications, fire protection, and security. RPMA involves repair of facilities. The BOS and RPMA costs of separate siting (Table III-17) were derived by adjusting the costs obtained from the sites in the data call. These adjustments were made for the purpose of isolating incremental costs to DoD, as opposed to inter-Service payments arrived at through negotiation.

The first column in Table III-17 lists the payments for BOS and RPMA services that the Army makes to NWS Charleston, its host. These payments, which are set by negotiation between the Army and the NWS, are listed in the Inter-Service Support Agreement (ISSA) between the two commands.

We decided not to use these figures to estimate savings in BOS and RPMA under collocation. For one thing, the figures are far from incremental costs to DoD. Because NWS Charleston was operated under the Defense Business Operations Fund (DBOF) during data-gathering for this study, the Army costs for direct labor that are included in these figures are set by a standard rate that is heavily burdened with overhead charges. Actual reductions in the site's direct labor force due to collocation might be too small to release overhead resources, and will therefore be overestimated. The incremental costs of such changes should reflect only the actual salary and fringe benefit of the employees involved, not the standard rate.

**Table III-17. Cost of BOS and RPMA at Charleston
(Thousands of FY 1997 Dollars)**

	ISSA Cost	Incremental Costs		
		Personnel	Other	Total
Environmental compliance	\$197	—	\$50	\$50
Fire protection	\$1,223	\$345	\$4	\$349
Recycling	\$7	—	—	—
Police	\$743	\$113	—	\$113
Safety	\$5	—	—	—
Shuttle	\$251	\$67	\$10	\$77
Automatic data processing	\$75	—	\$75	\$75
Communications	\$87	—	\$87	\$87
Custodial	\$101	—	\$82	\$82
Engineering support	\$148	\$62	—	\$62
Non-tactical vehicles	\$162	—	\$162	\$162
Traffic management	\$472	\$128	—	\$128
Legal	\$3	—	—	—
Refuse and disposal	\$101	—	\$82	\$82
Railroad operations	\$268	\$67	\$40	\$107
Utilities	\$1,045	—	\$418	\$418
Facilities and real property maintenance	<u>\$2,733</u>	<u>\$802</u>	<u>\$157</u>	<u>\$959</u>
<i>Total</i>	\$7,600	\$1,600	\$1,200	\$2,800

As another example, people at NWS Charleston said there was no need to build a new fire station when the Army prepositioning organization came to Charleston. Conversely, there would be no incremental savings in fire protection if the Army collocated to Blount Island.

As an alternative to using the ISSA rates, we obtained data on direct costs from people at Charleston and Blount Island. These figures, shown in the remaining columns of Table III-17 for Charleston and in Table III-18 for Blount Island, are estimates of the incremental costs of the BOS and RPMA services to DoD. For example, if the Marine Corps relocates to Charleston, the total cost for police would be the \$113,000 separate siting cost of police at Charleston less the \$94,000 the Marines were paying at Blount Island and plus the \$28,000 of added police costs at Charleston. We developed these estimates by first determining, through discussion with people at NWS Charleston and Blount Island, the number of people in each grade and in each functional area that could be released through reductions in force if the prepositioning site did not exist. We multiplied these numbers of people by the salaries and fringe benefits of the various pay grades, rather than by the DBOF standard rate.

**Table III-18. Cost of BOS and RPMA at Blount Island
(Thousands of FY 1997 Dollars)**

Police	\$94
Communications	\$309
Custodial	\$196
Refuse and disposal	\$99
Utilities	\$560
Property repair	\$288
Improvements	\$111
Dredging	\$500 ^a
Additional cost to own	<u>\$600^a</u>
<i>Total</i>	<i>\$2,757</i>

^a Source: Reference [4].

The Marine Corps receives BOS and RPMA services directly and through its lease with Gate Maritime Properties, Inc. Blount Island reported the direct costs of these services in its response to the data call. We were unable to obtain data on the costs that are included in the lease payment, and relied instead on estimates in Reference [3]. That study calculated the costs of BOS and RPMA as part of its estimate of the costs of ownership—the costs the Marine Corps would incur if it purchased rather than leased Blount Island. We eliminated the costs that duplicated those already reported in the data call.

Table III-19 lists the costs under separate siting and our estimates of the additional costs that would be incurred under collocation. The Blount Island costs that were listed as property repair, improvements, and additional cost to own in Table III-18 are reported as RPMA in Table III-19.

The “Marine Incremental” column in Table III-19 lists the additional BOS and RPMA costs incurred, over and above the costs for the Marine Corps under separate siting, if the Marine Corps operation were relocated to Charleston. For example, police would cost a total of \$141 thousand annually under collocation at Charleston: \$113 thousand for the Army under separate siting plus an incremental \$28 thousand due to the relocation of the Marine Corps. (The calculation of BOS and RPMA costs include both fixed and variable components, so the \$28 thousand of incremental costs should not be thought as strictly associated with the Marine Corps.) Similarly, the “Army Incremental” costs are the additional annual costs, over and above the costs for the Army under separate siting, if the Army relocated to Blount Island. Communications, for example,

would cost \$396 thousand annually: \$309 thousand for the Marine Corps under separate siting plus an additional \$87 thousand for the Army.

**Table III-19. Annual Cost of BOS and RPMA
(Thousands of FY 1997 Dollars)**

	Separate Siting			Collocation at CHS		Collocation at BI	
	CHS	BI	Total	Marine Incremental	Total	Army Incremental	Total
BOS							
Environmental compliance	\$50	—	\$50	—	\$50	\$50	\$50
Fire protection	\$349	—	\$349	—	\$349	—	—
Police	\$113	\$94	\$207	\$28	\$141	—	\$94
Shuttle	\$77	—	\$77	\$77	\$154	—	—
Automatic data processing	\$75	—	\$75	\$75	\$150	\$75	\$75
Communications	\$87	\$309	\$396	\$309	\$396	\$87	\$396
Custodial	\$82	\$196	\$278	\$82	\$164	\$148	\$344
Engineering support	\$62	—	\$62	—	\$62	\$62	\$62
Non-tactical vehicles	\$162	—	\$162	—	\$162	\$162	\$162
Traffic management	\$128	—	\$128	—	\$4,128	\$128	\$128
Refuse and disposal	\$82	\$99	\$181	\$58	\$140	\$75	\$174
Railroad operations	\$107	—	\$107	\$107	\$214	—	—
Utilities	\$418	\$560	\$978	\$294	712	423	983
Dredging	—	\$500	\$500	—	—	—	\$500
<i>Total</i>	\$1,791	\$1,758	\$3,549	\$1,030	\$2,821	\$1,160	\$2,918
RPMA							
Charleston	\$959	—	\$959	\$676	\$1,635	—	—
Blount Island	—	—	—	—	—	—	—
Not included in lease	—	\$399	\$399	—	—	\$754	\$1,153
Included in lease	—	\$600	\$600	—	—	—	\$600
<i>Total</i>	\$959	\$999	\$1,958	\$676	\$1,635	\$754	\$1,753

H. OTHER FACILITY SUPPORT

This section considers a variety of activities that support the maintenance operations at Charleston and Blount Island but that do not fit conveniently in the previous cost categories. The detailed costs are in Table III-20 and summarized in Table III-21. Because collocation would not alter the maintenance workloads at the sites, we assumed that these activities and their costs would remain unchanged as well. Although there might be some economies of scale in automation, computer activities are generally tailored to the specific needs of the individual commands, and these needs would not change in a collocation of autonomous commands.

**Table III-20. Cost of Other Facility Support
(Thousands of FY 1997 Dollars)**

	<u>Cost</u>
Support of Charleston operations	
Army's Packing, Shipping and Crating Center	\$82
Automatic data processing equipment	\$50
Logistics Management Institute	\$100
Automation	\$2,566
Supplies and equipment	\$30
Army Medical Materiel Agency	\$413
Industrial Operations Command	<u>\$440</u>
<i>Total</i>	\$3,681
Support of Blount Island operations	
Temporary duty, temporary additional duty	\$425
Container replacement	\$1,800
Automated Information Systems	\$927
Inter-Service Support Agreement	\$39
Wood recycling	\$65
Other	<u>\$2,994</u>
<i>Total</i>	<u>\$6,250</u>

**Table III-21. Annual Cost of Other Facility Support
(Millions of FY 1997 Dollars)**

<u>Separate Siting</u>			<u>Collocation at CHS</u>		<u>Collocation at BI</u>	
<u>CHS</u>	<u>BI</u>	<u>Total</u>	<u>Marine Incremental</u>	<u>Total</u>	<u>Army Incremental</u>	<u>Total</u>
\$3.7	\$6.3	\$9.9	\$6.3	\$9.9	\$3.7	\$9.9

IV. UNCERTAINTY OF COSTS

This chapter deals with several issues bearing on the uncertainty of our cost estimates: the differences in cost between single-shift and double-shift operations (Section A), the effects of the uncertain factors highlighted in the earlier chapters (Section B), the collocation savings as a percentage of the total costs of the sites (Section C), and the implications of mis-estimating cost in past BRAC actions (Section D).

A. SINGLE-SHIFT VERSUS DOUBLE-SHIFT OPERATIONS

As we mentioned previously, we considered two operational variations in estimating the resources required for collocation: a substantial expansion in facilities operated with a single manpower shift (the base case) and a smaller increase in facilities operated with a double-shift workforce. The effects on cost are shown in Table IV-1. The costs for separate siting and the collocation base case (single-shift operation) are from Table I-1. The collocation costs for double-shift operation were derived in Chapters II and III. Chapter II showed that invoking the second option (double-shift operation) lowered the costs of facility military construction (a one-time cost) because of the reduction in the number of maintenance facilities. The analysis in Chapter III showed that the costs of the contractor workforce (an annual cost) increase because of the inefficiencies and distaste associated with double-shift and night-time work. All other costs are the same in the two options.

The discounted collocation savings over 5 years are approximately the same for the two operations, but the base case becomes substantially cheaper for longer time horizons.

This result was surprising. We expected that the cost of additional facilities in the single-shift case would exceed the cost penalty for night-time operation in the double-shift case. Indeed, the figures in Table IV-1 show that compared to the single-shift case, the double-shift option saves \$31 million in facility military construction (\$53.8 million minus \$22.8 million) but costs \$6.7 more (\$77.6 million minus \$70.9 million) in the contractor workforce. The military construction, however, is a one-time savings whereas the added contractor costs occur yearly. The single-shift case thus becomes cheaper for time horizons beyond 5 years.

**Table IV-1. Costs of Single- versus Double-Shift Operation
(Millions of FY 1997 Dollars)**

	Separate Siting	Collocation at Charleston		Savings From Separate Siting	
		Single Shift	Double Shift	Single Shift	Double Shift
Cost Factors, Undiscounted					
Facility military construction (one-time)	—	\$53.8	\$22.8	—	—
All other one-time costs	<u>\$96.0</u>	<u>\$90.3</u>	<u>\$90.2</u>	—	—
<i>Total</i>	\$96.0	\$144.1	\$113.0	-\$48.1	-\$17.0
Contractor workforce (annual)	\$76.6	\$70.9	\$77.6	—	—
All other annual costs	<u>\$77.7</u>	<u>\$73.5</u>	<u>\$73.4</u>	—	—
<i>Total</i>	\$154.3	\$144.4	\$151.0	\$9.9	\$3.4
Totals, Discounted					
5 years	\$747	\$749	\$748	-\$2	-\$1
10 years	\$1,312	\$1,278	\$1,302	\$34	\$10
20 years	\$2,215	\$2,122	\$2,185	\$93	\$30

In addition to costing less, the single-shift option has an operational advantage of higher surge capability. (A substantial increase in capability might be needed, for example, if all the prepositioning ships of both Services had to respond immediately to a major contingency, and all the cargo required maintenance immediately thereafter because another contingency was threatening). Maintenance output could be quickly doubled by hiring a second shift of contractors from the ready pool of retired Service maintenance people that exists along the Eastern seaboard. It would be impossible to quickly double output with the second option: adding on a third shift would increase output by at most 50%, and probably less after allowing for time to maintain the repair equipment and the inefficiencies of a midnight shift. And purchasing more facilities would take time.

B. UNCERTAIN COST FACTORS

Sensitivity analysis of factors in the cost calculations shows that the savings of collocation could be much smaller than we've estimated. The uncertain factors mentioned in Chapters II and III are listed in Table IV-2 along with the values used in the single-shift case. (The terms PSCC estimate, BI estimate, and IDA estimate are explained in those chapters.) The effects of the alternative assumptions (lower and higher savings) on the cost savings of collocation are summarized in Table IV-3. The different assumptions lead to different break-even points, from 3 years (higher savings) to 10 years (lower savings).

Table IV-2. Uncertain Factors

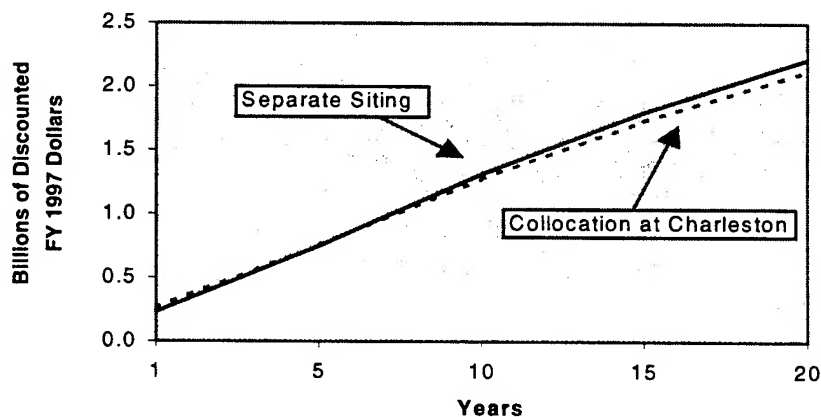
	Base Case	Lower Savings	Higher Savings
Reduction in contractor overtime	50%	25%	75%
Reduction in contractor management and administration savings	75%	60%	90%
Personnel transition costs	3 months	6 months	None
Additional storage square feet at Charleston	PSCC estimate	BI estimate	PSCC estimate
Movement of things from Blount Island to Charleston	IDA estimate	BI estimate	IDA estimate
Hinge Marine Corps ship masts	\$5 million	\$3 million	\$5 million

**Table IV-3. Effects of Uncertain Factors on Cost
(Costs in Millions of Discounted FY 1997 Dollars)**

	20-Year Costs			Approximate Break-Even Points
	Separate Siting	Collocation at Charleston	Total Savings	
Base case	\$2,215	\$2,122	\$93	5 years
Lower savings	\$2,215	\$2,166	\$48	10 years
Higher savings	\$2,215	\$2,092	\$123	3 years

C. SAVINGS VERSUS TOTAL SITE BUDGETS

The base case savings of \$93 million from collocation at Charleston (Table IV-3) are only 4.2% of the total cost of separate siting (approximately the combined budgets of the two commands, discounted). Thus, a relatively small percentage estimating error could eliminate the entire collocation saving. Figure IV-1 shows this graphically.

**Figure IV-1. Total Costs of Separate Siting versus Collocation**

The costs of separate siting and collocation are nearly indistinguishable. The lower savings case in Table IV-3 shows that the savings could be half as large, only 2.2% (\$48 million divided by \$2,215 million). The implication is that unknown uncertainties could easily eliminate *all* savings.

D. ESTIMATION ERRORS IN PAST BASE REALIGNMENTS

Cost estimates for past base realignment actions carried out under the Base Closure and Realignment Commission (BRAC) appear to contain a systematic bias. If that bias is symptomatic of studies of large-scale actions that are conducted without detailed engineering analysis, it may apply to the present analysis as well.

A recent report by the General Accounting Office GAO [1] bears on this issue. It deals with realignment actions taken in BRAC rounds I, II, and III on ten maintenance depots, bases with a similar mission to that of the prepositioning maintenance sites analyzed in our study. The Services were required to estimate the savings for these actions using the aggregate Cost of Base Realignment Actions (COBRA) model. Table IV-4 lists the dates of these estimates, assuming that the COBRA estimates were made in the year before the BRAC decision (which preceded the actual realignment action by several years).

The first three columns of Table IV-5 repeat the GAO figures that compare the COBRA estimates with the budgets the Services eventually requested to perform the realignment action (see footnotes to the table for slight differences with the GAO figures). Since the Service requests come at least 3 years after the COBRA estimates and just before the realignment action itself (Table IV-4), we assumed that the Service estimates are better than the COBRA estimates; they were likely made with greater engineering detail in anticipation of the realignment action. In any case, they were closer to the amounts actually spent, and show that the actions required 31% more one-time cost and produced 23% fewer annual savings than indicated by the COBRA estimates. The GAO report gave the following reasons for the changes: fewer eliminations of personnel and larger costs for civilian relocation and environmental cleanup.

The remaining columns of figures in Table IV-5 draw out the implications of the GAO results for our analysis. Column 4 repeats our base case estimates: \$44 million in initial costs (Table I-3), \$6.9 million in annualized operating savings (20-year discounted savings of \$137 million from Table I-3 divided by 20), and \$4.7 million in annualized net savings (\$6.9 million times 20, less \$44 million, and then divided by 20). The fifth column shows the

product of the base case figures and the percentage errors from the BRAC actions. The annualized net savings fall from \$4.7 million to \$2.4 million—from 4.2% to 2.1% of the present costs of the two sites (\$2,215 million discounted 20-year costs of separate siting from Table I-4 divided by 20).

Table IV-4. BRAC Actions on Ten Maintenance Depots

Depot	Action	BRAC Round	Date of:		
			COBRA Estimate	Service Budget Request	Realignment Action
Lexington-Bluegrass Army Depot	Realignment	I (1988)	1987	1994	1995
Sacramento Army Depot	Closure	II (1991)	1990	1995	1995
Philadelphia Naval Shipyard	Closure	II (1991)	1990	1995	1996
Charleston Naval Shipyard	Closure	III (1993)	1992	1995	1996
Mare Island Naval Shipyard	Closure	III (1993)	1992	1995	1996
Alameda Naval Aviation Depot	Closure	III (1993)	1992	1995	1997
Norfolk Naval Aviation Depot	Realignment	III (1993)	1992	1995	1997
Pensacola Naval Aviation Depot	Realignment	III (1993)	1992	1995	1996
Tooele Army Depot	Realignment	III (1993)	1992	1995	1996
Aerospace Guidance and Metrology Center, Newark Air Force Base	Privatization	III (1993)	1992	1995	1996

Table IV-5. BRAC COBRA Estimates versus Later Budget Estimates for Closing or Realigning Ten Maintenance Depots (Costs in Millions of FY 1997 Dollars)

	BRAC Realignment Experience ^a			IDA Collocation Savings	
	COBRA Estimate	Later Service Estimate	Percentage Change	Base Case	Re-Estimated
One-time costs	\$1,757	\$2,296	+31%	\$44	\$58
Annualized operating savings	\$537.3 ^b	\$415.7 ^b	-23%	\$6.9	\$5.31
Annualized net savings	—	—	—	\$4.7 ^c	\$2.4 (2.1%)

^a The source of the BRAC figures are Reference [1]. The figures in [1], which were expressed in FY 1996 dollars, were increased by 2.6% to yield the figures in the table.

^b The 6-year savings reported in Reference [1] divided by 6. We deleted the savings from selling government land to the local communities.

^c Annualized operating savings times 20 years (long-term horizon), less one-time costs, and then divided by 20.

V. STRATEGIC RISKS

Collocating Charleston and Blount Island would have implications beyond those of cost. We considered the following "strategic" considerations:

- Management problems:
 - loss of responsiveness due to more layers of management (Joint Command);
 - separation of afloat prepositioning from the rest of war reserve materiel management;
 - separation of maintenance and operational functions; and
 - conflicts with Title X issues.
- Operational risks:
 - vulnerability to weather, labor unrest, and terrorism;
 - disruption of operations during transition;
 - loss of flexibility due to loss of a port; and
 - loss of excess capacity for expansion of prepositioning force.

The remainder of this chapter discusses them in turn. In general, they argue against consolidation.

A. MANAGEMENT PROBLEMS

An organization headed by a Joint Command (or an Executive Agent) could be less responsive because it would create one additional layer of management. Collocating the two commands, moreover, would separate the management of afloat prepositioning maintenance from that of other logistics organizations related to maintenance such as other war reserve functions and depot maintenance and storage in the United States and abroad.

Collocation would also separate maintenance and operational functions. Moreover, there is no precedent for establishing a maintenance-only command. Doing so would require development of procedures, policies, and so on. Separating maintenance from operational control violates the principle of unity of command and might result in

orders being issued by three separate groups—the Services, the over-arching command (Joint Command or Executive Agent), and the supported CINCs. (Currently, the Services handle maintenance issues and the CINCs, through the Joint Staff and Military Sealift Command, specify operational requirements.)

Some people have raised the possibility that collocation under either a Joint Command or an Executive Agent would conflict with Title X of the US Code. As amended by the Goldwater-Nichols Department of Defense Reorganization Act of 1986, Title X does give the Service Secretaries the responsibility for “construction, outfitting, and repair of military equipment” [2]. Both Services would obviously surrender some management control under a Joint Command. And one of the Services would surrender some control if the other one were made the Executive Agent. However, the three sections containing the above quotation (one for each Service) each begin with the following words: “Subject to the authority, direction, and control of the Secretary of Defense.” A decision by the Secretary of Defense to collocate the two sites does not, therefore, appear to violate Title X.

B. OPERATIONAL RISKS

1. Vulnerability to Threats of Weather, Labor Unrest, and Terrorism

a. Weather

The South Carolina and Florida coasts sometimes experience severe weather from the hurricane season that extends from June through October. Offload operations can be halted and prepositioning equipment damaged by high winds and flooding due to high tides and heavy rains. Since individual hurricanes and severe storms generally deliver their greatest effects in areas that are small compared to the 200 miles that separate Blount Island and Charleston, it is unlikely that both sites would be severely hit at the same time. Separate siting thus offers a smaller chance of losing all capability to weather; conversely, collocation would increase the risk of degrading the prepositioning programs of both the Army and Marine Corps.

The National Climatic Data Center (NCDC) and the South Carolina State Climatology Office gave us a data base (the National Climatic Data Center, Global Tropical and Extratropical Cyclone Climatic Atlas) on hurricane and tropical storm activity in the South Carolina-North Florida region. NCDC is the custodian of all US weather records, which include the tracks and related data for all tropical storms in the South Atlantic basin occurring so far this century. In addition, the state of South Carolina

provided us with a report that estimated the probability and severity of future tropical storms for South Carolina counties [7]. Using these data, we determined that over 300 hurricanes and tropical storms have occurred in the general vicinity of Charleston, South Carolina, and Jacksonville, Florida, during the last 50 years.

We also contacted NWS Charleston and the Blount Island command to determine their actual storm-related damage experience in recent years. Blount Island reported that it had yet to be closed or damaged due to weather in its 13 years of operation. At Charleston, hurricanes caused losses of only 10 work days during the 8 years from 1989 to the present: 10 days from Hugo in September 1989, 4 days from Bertha in July 1996, and 2 days from Fran in September 1996. The number of days that the base was closed somewhat understates the loss in service, since ships might have to take the time to steam out of port, wait out the storm off-shore, and steam back afterwards. This could suspend maintenance operations for a week.

In summary, this information suggests that while separate siting would decrease the chance of losing the combined maintenance capability due to weather, the advantage would be small.

b. Labor Unrest

Although the current contractor organization at Charleston reports no labor problems in 35 years of service to various military activities at the base, and Blount Island has had none in its 10 years of existence, future uncertainty remains. Maintaining two sites would offer some protection against the threat of future labor unrest.

c. Terrorism

Vulnerability to terrorism, either foreign or domestic, is not as easily dismissed as weather and strikes. We discussed security vulnerabilities and possible countermeasures with the Security Officer at NWS Charleston, the Risk Management Officer at Combat Equipment Group Asia (the command that manages the Charleston prepositioning maintenance site), and security personnel at Headquarters, Marine Corps. NWS Charleston provides a range of services to Combat Equipment Group Asia, including badging visitors, guarding gates, maintaining perimeter security around staging areas, and securing local roads used to transport equipment and ammunition from pier to maintenance shops. A fence around the maintenance area is currently being improved. This area was previously used by the Navy for nuclear weapons staging and is considered to have good residual security.

A separate problem is the threat to ships traveling the channel from the Atlantic to the government property perimeters at both sites. No major security measures are being considered for these transits at present. However, the security officer at NWS Charleston told us that Charleston County and the Coast Guard patrol the river and the ships have some self-protection capability.

According to a report from a recent security site inspection of Blount Island provided by the Marine Corps [8], only one US Marine Corps Military Police Officer works at Blount Island. Gate Maritime Properties, Inc., which owns the property, provides unarmed guards at the point of access to the island. The Marine Corps, however, provides armed guards for ammunition-loading operations. The report recommended a number of security improvements, including the establishment of an auxiliary security force.

Both sites are somewhat vulnerable to a concentrated terrorist attempt to disrupt maintenance activities. Beyond observing that more military police might be useful at Blount Island, we did not attempt to quantify risks to the prepositioning sites or to estimate the cost of reducing the risk. It seems that collocation would clearly increase the risk in that a single attack could disable both maintenance activities at once. However, there is no historical evidence that would allow us to estimate the added vulnerability of a single site in the future.

2. Disruption of Operations During Transition

We cannot be sure that prior planning would eliminate all possibilities of disruption during the transition to a collocated site. Although our cost analysis allows for 3 months of personnel costs at the losing site during transition, the Blount Island command estimated that up to 6 months might be required for a collocated base to achieve full operation. Maintaining two ports would offer a measure of flexibility that could be valuable in the event of major military actions in the future. Finally, loss of a port would lower capacity to handle a sizable expansion in future afloat prepositioning force levels.

3. Loss of Flexibility Due to Loss of a Port

Our cost analysis found that with extra resources, either Charleston or Blount Island could physically maintain the prepositioning fleets of both Services—an average of ten or eleven ships per year (eleven Army and sixteen Marine Corps ships every 30 months). This analysis implicitly assumed that at least one wharf area at each site would

be dedicated to this mission. We tested the validity of that assumption by considering whether each site has enough port capacity to handle its other traffic without interfering with the schedule of the prepositioning ships. There are three questions to consider:

1. Are there enough docks and staging areas?
2. Can ammunition be handled?
3. Can the ports handle surge conditions during periods of crisis?

In addition to the Army prepositioning ships, NWS Charleston currently supports some Navy ammunition underway replenishment ships and Department of Energy (DoE) ships carrying nuclear cargo. Charleston's port resources are four piers (we use "pier" as a generic term to cover wharves, piers, and docks):

1. Wharf Alpha, the pier with the greatest capability, would handle the Army LMSRs and, presumably, the Marine Corps MPSs, as well as the Navy missile ships and the DoE ships. (Navy ballistic missile submarines, which formerly used wharf Alpha, are no longer based at Charleston.)
2. Pier Bravo is currently the most active loading site. It handles approximately two-thirds of the NWS traffic, primarily the Navy combatants that load and unload ammunition.
3. The Transportation Command (TC) dock is operated by the MTMC.
4. Pier Charlie is a smaller and older pier that would require improvement if it were to be used as an alternate pier for loading ammunition. We do not address this pier in the following discussion.

With one exception, cargo can be loaded at each of these piers simultaneously without interfering with operations at adjacent piers. In fact, two DoE ships were recently handled simultaneously at wharf Alpha without difficulty. The only exception occurs when the tonnage of explosive cargo being loaded at pier Bravo exceeds the pier's net explosive weight (NEW) limitation. At these times, the NEW arc (radius of significant impact of explosion) reaches over adjacent piers, and the areas must be cleared of nonessential personnel.

Piloting is not a constraint at Charleston. NWS Charleston employs two river pilots who are familiar with the turns and currents in the Cooper River. They bring ships to the piers and, after loading, take them through the turning area that can accommodate the largest ships we have been discussing. The turning area can apparently be cleared within a half hour.

Table V-1 presents data that show that wharf Alpha can handle at least 29 ships per month. The data, which were obtained from NWS Charleston activity logs, show that traffic in that port has decreased greatly since the Persian Gulf War: The mean number of ships handled per month has fallen by a factor of 6.5, a trend that holds for the monthly data as well as the yearly averages. Table V-2 shows that wharf Alpha is currently being used at much less than its total capacity.

Table V-1. NWS Charleston Ship Traffic in Wharf Alpha, 1990–1996

Year	Mean Number of Ships Handled per Month ^a	Standard Deviation
1990	29.1	6.8
1991	28.0	6.8
1992	21.0	5.2
1993	14.3	4.1
1994	11.0	6.1
1995	8.3	4.2
1996	4.5	2.6

^a Figures are calculated from monthly activity logs for January 1990 through September 1996.

Table V-2. Use of Wharf Alpha

User	Rate of Use	Length of Each Use
Army prepositioning ships	1 ship per month	5 days
DoE ships	1 ship per 90 days	1 day
Navy missile ships	3 ships per month	3 days

The Army has executed an agreement with the Navy that guarantees the Army prepositioning command priority use of wharf Alpha and the rail lines and road network that service it [9]. Moreover, the TC dock and the surrounding facilities are being improved to support the prepositioning maintenance operations.

The missile ships can be accommodated at pier Bravo if wharf Alpha is in use. The TC dock, which is capable of handling the Marine Corps MPSs as well as the Army's smaller ships—those other than the coming new LMSRs—is also available as an alternative.

Information supplied by NWS Charleston's Waterfront Control Officer indicated that NWS Charleston can accommodate six prepositioning maintenance ships per month under surge conditions. Each ship spends 3 to 4 days at wharf side, enough time to

accomplish loading or unloading using a two-shift operation if necessary. In the event of a schedule conflict at wharf Alpha, the TC dock could serve as an alternative.

The port at Blount Island is located on the St. Johns River, about 6 miles from the Atlantic Ocean. It is a private facility leased by the Marine Corps. (Other ports on Blount Island are part of the Jacksonville Port Authority and are not available to the Blount Island command.) The port currently has a single 1,000-foot pier that can handle the largest of the Marine Corps and Army prepositioning ships (including the coming new LMSRs). The lease gives the Marine Corps priority use of the pier at all times.

For safety reasons, the Blount Island command is not allowed to maintain ammunition at the site. Ammunition is transported by rail to NWS Charleston for maintenance. Again for reasons of safety, these offloading operations are generally handled during weekends. The operations can, however, be conducted during the week if necessary, in which case personnel within the explosive arc must be notified and the area cleared.

During the 18 months of the Persian Gulf War (September 1990 to February 1992), 53 ships were loaded at Blount Island [10]. This activity averages only 2.9 ships per month, but as with NWS Charleston, Blount Island should be capable of handling a surge of six ships per month during a contingency by using a second manpower shift to expedite unloading.

We conclude that both NWS Charleston and Blount Island have adequate capacity of piers, staging, and railheads to support collocated Army and Marine Corps prepositioning programs. Port capacity is not a limiting factor in the collocation decision.

4. Loss of Excess Capacity for Expansion of Prepositioning Force

Although port capacity is not a limiting resource for collocation of the *current* maintenance operations, it could become a constraint if DoD were to plan a major increase in the size of the afloat prepositioning fleets. We know of no current plans to do so, beyond the recent increases to eleven Army and sixteen Marine Corps ships to be maintained at Charleston and Blount Island, respectively. However, these increases do suggest that afloat prepositioning is regarded as an important part of US defense posture, and could become increasingly so given the recent transition from major war to regional conflicts. Keeping both maintenance sites would be a hedge against the possibility of a major future expansion.

VI. CONCLUSION AND RECOMMENDATION

Our analysis shows that although a collocated prepositioning maintenance site could be sized to maintain support to the CINCs, it would offer small and uncertain cost savings and could lead to strategic drawbacks. Taking cost and strategic considerations together, we found no compelling reason to collocate the Charleston and Blount Island prepositioning maintenance sites.

If the Army and Marine Corps afloat prepositioning maintenance organizations are allowed to continue operating at their current sites, the government should purchase the Blount Island site if the purchase price promises a long-term saving over the \$11 million yearly lease.

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ABBREVIATIONS

AGSE	Air-Ground Support Equipment
AMC	Army Material Command
BI	Blount Island
BOS	base operating support
BRAC	Base Closure and Realignment Commission
CHS	Charleston
CINC	commander in chief
COBRA	Cost of Base Realignment Actions
COEA	Cost and Operational Effectiveness Analysis
DBOF	Defense Business Operations Fund
DoE	Department of Energy
FCG	Facility Category Group
GAO	General Accounting Office
HMMWV	high-mobility multipurpose wheeled vehicle
IDA	Institute for Defense Analyses
ISSA	Inter-Service Support Agreement
LMSR	large medium-speed RO/RO
MCLB	Marine Corps Logistics Base
MPF	Maritime Prepositioning Force
MPS	Maritime Prepositioning Ship
MRE	Meal Ready to Eat
MTMC	Military Traffic Management Command
NCDC	National Climatic Data Center
NEW	net explosive weight
NSE	Naval Support Equipment
NWS	Naval Weapons Station
PCS	Permanent Change of Station
PSCC	Packaging, Storage, and Containerization Center
PP&P	Packaging, Packing, and Preservation
RO/RO	roll-on/roll-off
RPMA	real property maintenance activity
T-ACS	auxiliary crane ship
TC	Transportation Command

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